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SCIENCE AND PRACTICE
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INDEX

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The International Review of the Science and Practice of Agriculture

This *Review* is the world organ for the speedy distribution of information relating to progress in agricultural science and research, livestock improvement, farm engineering, farm industries, rural economics and plant diseases.

Part I consists of ORIGINAL ARTICLES on the most important questions of the moment contributed by leading specialists in the various countries. A carefully co-ordinated series of articles is reserved for the principal agricultural problems (especially those connected with tropical questions) of international importance.

From 1925 onwards, Part II will be devoted to the work of the INTERNATIONAL ASSOCIATIONS connected with the Bureau of Agricultural Science of the International Institute of Agriculture, such as the International Society of Soil Science, the International Seed Testing Association, the International Association of Poultry Instructors and Investigators, etc.

Part III will deal with the work of the BUREAU OF AGRICULTURAL SCIENCE of the International Institute of Agriculture in the international sphere, in connection with conferences, agreements, conventions, etc.

Part IV contains GENERAL INFORMATION abstracted from the scientific and technical publications of the various countries. This Section is an essential feature of the Review.

Part V consists of CURRENT NOTICES referring to world agricultural movements, legislative and administrative measures, agricultural institutions, congresses, meetings, exhibitions, fairs, etc. The importance of this Section will be readily recognised, the Institute being the only centre which receives the agricultural publications of the entire world, and having also at its disposal special correspondents in the different countries.

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The Editiors notes are marked (*Ed.*); the letter *R.* indicates the references to the foregoing issues (Monthly and Quarterly) of the International Review.

ORIGINAL ARTICLES

NEW THEORY OF SOLUTIONS.

> *"If the hypotheses at present accepted, and those set forth in the present investigation, should be found imperfect in the future, they will none the less have played an important part in having kept interest alive, in having served as a stimulus to experimental investigation and in being the result of attempts at perfect scientific reasoning".*
>
> (D. Mendeléeff).

The Chair of Scientific Investigation, with regard to the technology of agricultural industries, is carrying out under my direction a series of systematic investigations, directed towards finding a scientific basis for various problems of a practical nature which arise in the course of work in agricultural industries. Such was the origin and character of the present investigation for determining the laws which govern the process of crystallisation, a phenomenon of great scientific interest, which plays a very important part in industry generally and in agricultural industries in particular.

It is a well-known fact in the history of chemistry that the development of this science has received a fresh impetus and made very rapid advances since it has been possible to apply methods of weighing and volume measurement to various chemical phenomena. It is for this reason that research has been undertaken respecting crystallisation, a branch of science as yet so little known, by first attempting to find a means of measuring the phenomena which it is wished to place under observation in our tests. Many scientists have sought a means of determining the processes of crystallisation, but none have so far succeeded.

The good fortune of finding a solution to this problem has fallen to our lot. After numerous experiments we have discovered, *inter alia*, a fundamental law of crystallisation, which is as follows: the conditions under which crystallisation takes place being constant, the quantity of matter added to each unit of surface in unit time is always the same. Basing on this principle, a means has been found to estimate the rate of crystallisation and this phenomenon can now be measured with great exactitude in a very simple, expeditious and easy way.

In investigating any crystallisation phenomenon it is sufficient to measure a large number of similar phenomena and, on the basis of the measurement results obtained, general deductions may be drawn concerning the law which governs the phenomenon in question. This work requires a long series of experiments, which can only be carried out at the expense of much time and work; it also involves a series of complicated calculations. This work is now being carried on and the results are published from time to time. The results of these researches are, however, already quite assured and their completion is only a question of time. Only summary indications are given here, for the question of the rate of crystallisation is not the object of the present article. Those interested in the results of these investigations on the rate of saccharose crystallisation and in the methods applied in the present work are referred to the publications already issued on this question (1). In the present article it is desired to call the attention of the reader to another subject.

In the study of crystallisation there is another question of very great importance which has long since awakened the interest of the scientific world, and that is the question of the origin of the crystal, the causes which determine its formation. A whole series of complicated theories on this question are already known to science, and we will confine ourselves to briefly indicating their chief characteristics.

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(1) See: *Le Messager de l'Industrie sucrière en Ucraine.* (The Sugar Industry Messenger, in Ukraine); *Wesinik Zukrovoi Promyslovosti* (Ucraina-Kiew) 1921, Nos. 7, 10, 12; 1922, Nos. 3, 4, 9, 10; 1923, No. 5; *Zapiski naoutchno-izledovatelskoi kathedry technologii selsko-khoziastvenvych proizvodstv.* (Memoirs of the Chair of Scientific Investigation on the Technology of Agricultural Industries, in Russia): Prof. T. Kucharenko, Kiev, 1924, pp. 126-173.

Certain men of science consider that the crystals are of spontaneous origin if the solution contains a sufficient quantity of matter capable of crystallisation. This is the physical and chemical theory. Others suppose that the formation of the crystals is dependent on the action of a mechanical agent on the matter contained in the solution, such as a shock, the shaking of the liquid, the action of mixing, friction, etc. ; this is the mechanical theory. Others, finally, affirm that the origin of the crystals in solutions is determined by the presence of crystal embryons of the same nature as are found in the air ; this may be termed the biological theory.

The tests made in studying this question show that, if the solutions of many substances are properly prepared so as to protect them against the admission of the crystal embryons in the air, the solution may be shaken and agitated at will, without crystallisation taking place, whatever be the quantity of matter dissolved in the solution ; the same solutions, super-saturated, immediately crystallise in open receptacles, that is, as soon as the crystal embryons of the same nature in the air penetrate therein.

Let us take a solution of this kind, prepared with great care to prevent the penetration of the crystal embryons of the same nature in the air ; if we succeed, while maintaining the same protection in concentrating the solution to the utmost, until there is nothing left after the complete evaporation of the water, but the total dissolved matter, and if we have at the beginning taken a sufficiently dilute solution, we shall obtain the dissolved substance in a non-crystalline form (amorphous or colloidal). As soon as this substance comes into contact, either through the air or in any other way, with crystals of the same nature, it will crystallise instantaneously; the phenomenon is accompanied with such an increase in heat, that generally the glass vessel in which the test is made, breaks.

Solutions of this kind were successfully prepared of a whole series of easily soluble substances, refractory to crystallisation, which were called *decrystallised.* There are certain less soluble substances, as for instance copper sulphate and others, which for a long time were not successfully obtained as decrystallised solutions ; however, when sufficiently diluted solutions were taken for evaporation, decrystallised solutions were obtained, even for many substances which dissolve with difficulty.

The phenomena just described, as well as others previously known, are not explained by the solution theories generally adopted by the scientific world. In order satisfactorily to explain these phenomena we have had to create a new solution theory, which will now be stated briefly.

According to our theory, crystalloid matter subjected to the action of water, detaches from its mass infinitely small particles, invisible under the microscope, which in turn undergo a series of gradual modifications. To simplify the matter two species of these particles are distinguished :

(1) the *crystallons*, which are infinitesimal particles, invisible even under the most powerful microscope, but which nevertheless retain all the characteristics of ordinary sized crystals.

(2) the *colloidons*, which are particles of the same dimensions as the foregoing, but which have lost the specific characters of crystals.

If a small quantity of a soluble substance be introduced into water, all the particles of this substance assume the form of colloidons ; a dilute solution is then obtained which is for the most part governed by the laws discovered in the investigation of gases ; these solutions differ in many respects from the denser solutions, and specially from the so-called saturated solutions. In evaporating a dilute solution, care being taken to keep it free from all contact with crystals of the same substance, a very dense and even saturated solution is obtained, but one which belongs to the species described as a decrystallised solution, because it cannot crystallise of itself, spontaneously.

If, on the contrary, at the outset, a larger quantity of soluble substance than is necessary to obtain a dilute solution, is introduced into the water, the solution will from the first contain not only particles of a colloidal form (colloidons), but also crystallons. The latter are so small that the most powerful microscopes do not reveal them, and the solution seems to be perfectly transparent. If this solution be then concentrated, even when all the necessary precautions are taken against the penetration of small crystals of the same matter, the solution will crystallise as soon as it has attained sufficient density ; indeed, in this case the solution already contains from the beginning, crystallons, which possess, as has been said, all the qualities of crystals ; consequently, at a certain degree of concentration of the solution, they may increase, detach other crystals from their mass, and thus cause the complete crystallisation of the whole substance contained in the solution.

Now, every theory must first satisfy two fundamental postulates : it must reasonably explain the known facts connected with a certain phenomenon, and allow facts still unknown to be foreseen by induction. Let us try to analyse our theŏry in order to see if it satisfies these requirements. It will be observed that our theory seems easily able to fulfill the first of these requirements. It explains, as we have seen, the undisputed fact that super-saturated solutions may be obtained for many substances, but which do not crystallise either if left at rest for a long time, or if subjected to the reaction of a mechanical agent ; for this purpose it is sufficient to prevent them from being penetrated by crystals of the same matter from outside, as for instance in the atmosphere, which contains myriads of particles of all the substances known on the earth under the form of dust atoms, invisible even under the microscope. These super-saturated solutions crystallise instantaneously when they are no longer thus protected.

This theory also explains the formation of calcium oxalate crystals in the leaves of plants. The plant takes its nourishment from the soil in the form of mineral solutions. Before reaching the leaf these solutions pass through the plant vessels and traverse the whole organism. These solutions may therefore bring to the leaf crystallons of substances which dissolve with difficulty, among others calcium oxalate crystallons. In consequence of the chemical and biological processes which take place in the leaf, the calcium oxalate in the latter accumulates in the form of a very dilute solution. The internal cavities of the leaves are completely protected from all penetration by the small crystals in the air. Consequently, the formation of crystals in the leaf is explained by the fact that the crystallons of the respective substances are introduced into the leaf with the sap or nutrient solutions, by the plant vessels ; it is these crystallons which cause crystallisation within the leaf, as soon as the solution has reached the necessary degree of concentration, owing to the evaporation of the water in the leaf.

The theory also explains the fact that sugar crystals are not obtained in the interior of the cells of the beet by drying the root, until all the water it contains has been eliminated. Indeed, sugar, being easily soluble, must exist in the root, before it is dried, in the form of a dilute solution containing no crystallons ; consequently, if the water be eliminated by drying, supersaturated, decrystallised, saccharose solutions are obtained in the interior of the cells.

The theory also gives a possible explanation of earthquakes. It has already been seen that the crystallisation of colloidal substances is effected almost instantaneously and is accompanied by an enormous liberation of heat and an immediate increase in volume, which generally breaks the retort in which the test is made. Let us imagine therefore, within the depths of the earth, an isolated space filled with matter in a colloidal form, for instance, gypsum, chalk, etc. By infiltration from outside, crystallons of the same matter are brought by solution into contact with this colloidal substance. The result will be a violent transformation of this colloidal substance into a crystalline formation. The duration of earthquakes is very short and does not generally last more than a few minutes; but there will be an instantaneous increase in volume, an enormous release of energy, causing a great increase of pressure and temperature, with all the consequences attendant thereon.

By means of the theory can be explained the well-known fact that the temperature of the earth does not become lowered, in spite of the considerable loss of heat through radiation into interplanetary space. The explanation given of this fact is that, in the interior of the earth the process of crystallisation takes place uninterruptedly and causes a continuous release of energy and heat, which keeps the temperature of our planet more or less constant.

Finally, the theory enables us to explain a whole series of other phenomena, the knowledge of which is less widespread among the uninitiated, but which chemists and physicists have long since investigated; such as, for instance, the formation of a crystallised precipitate when certain perfectly clear solutions are mixed; the effect of friction on the walls of the vessel, which is sometimes sufficient to bring about the formation of a crystalline precipitate; the effect of boiling in order to obtain crystalline precipitates of slightly soluble substances; the necessity of applying to laboratories which already possess the same substance in a crystalline form, for the crystallisation of rare compounds not capable of spontaneous crystallisation; finally, many other phenomena, well known in themselves, but of which no uniform explanation could be so far given.

These details cannot be examined here, as that would lead us far beyond the limits of the present article, which is only of a preliminary character. It is hoped in the near future to devote a series of articles to a methodical and detailed account of these phenomena and to their experimental demonstration, from the point of view of our theory.

Let us now try to subject the theory to a second test: does it allow the forecasting of certain phenomena hitherto unknown? Before solving this question, however, the reader must be warned that it will unfortunately require a certain time before our forecasts can be verified. Every prediction may be confirmed or refuted only by future experiment, and ours are no exception to the rule.

If the theory is right, it may logically be deduced from the following:

(1) In laboratory tests two kinds of solutions may be obtained containing equal quantities of a dissolved substance, but which show certain differences in character (isomeric solutions), for the substance they contain will be in the form of different molecular states and the quantity of latent energy at their disposal will also be different.

(2) As dilute solutions are governed by certain laws relating to gases, it follows that when the decrystallised solutions are concentrated, they must deviate from these laws, nearly in the same way as do gases reduced by compression to a certain degree of density.

(3) There are certain substances difficult to render soluble for which decrystallised solutions cannot be obtained by treatment in the laboratory. The reason of this is that the weakened solutions contain these substances in such small quantities that it would be necessary to evaporate enormous quantities of the solution to obtain merely a few grams of the dissolved matter; it is clear that this technical difficulty renders the operation almost impossible.

(4) Certain substances which are at present only known in their colloidal form and which are considered refractory to crystallisation, may be reduced to their crystalline form as soon as their crystallons have been discovered.

(5) The future elaboration of this theory should enable us to give a more concrete definition to the concept of "dilute solution", by ascertaining exactly the degree of concentration to which these solutions should be reduced in order to acquire all their inherent characters.

(6) The degree of density at which the solutions acquire the particular qualities which characterise the weakened solution, varies according to the action of the properties which come into play, whether as dissolving or as solublilising principles.

(7) The total crystallisation of a solution decrystallised and

condensed up to supersaturation, is the effect of the reproduction of a crystal which has entered into contact with the solution by a process of division.

(8) According to our theory, science is wrong at present in considering crystallisation to be a process of molecular combination or a more complicated composition of the substance. From our point of view crystallisation is, on the contrary, one of the phases of decomposition. Its result is to produce substances of simpler composition, since in passing to that form they lose part of their latent energy.

We will confine ourselves here to the theses enunciated, though it is possible to deduce many other logical consequences from this theory, certain of which will later be practically applied to the various branches of human knowledge.

The future will also show to what extent our theory is in conformity with the truth.

At present efforts are being concentrated on a series of tests for the purpose of verifying to the utmost, all the principles devolving from our theory ; cooperation is invited in this work from all those interested in the question, the solution of which will help to verify our theory and further its development,

From the point of view of the theory, crystallisation cannot take place except in the presence of crystallons, which in turn are only particles, invisible under the microscope, of ordinary crystals. The earth's crust being composed of a vast number of crystalline substances, the presence of crystallons in the atmosphere and in all solutions of non-artificial formation is easily explained. But the difficult question which arises is to show the origin of the first crystals which, by their reproduction, have caused the crystallisation of such an enormous mass. For the present we have no other reply to this question than that generally given as to the origin of the first cell which originated all the plant and animal life of our planet, when, in an extremely remote past, of which we have scarcely any knowledge, the conditions of the terrestrial globe and other planets, favoured the spontaneous formation of the first crystals. At present these conditions no longer exist, at least on our planet, and crystallisation no longer takes place except under the influence of particles of other crystals of the same nature already existing.

In conclusion it should be added that in our opinion the theory of solutions, and especially that of crystallisation, is very important for the future progress of science. I am personally convinced that the investigation of the structure of matter cannot be entered on until all questions regarding crystallisation have been elucidated. It is therefore indispensable to carry out this work, for on its results depend our future conceptions, more perfect than those now current, on the structure of matter. A deeper knowledge of these questions will doubtless mark a new stage in the progress of science.

Prof. T. A. KUCHARENKO,
President of the Chair of Scientific Research and
Director of the Institute of Scientific Research
on the Technology of Agricultural Industries,
Kiev (Ukraine).

THE ELECTROGENETIC LABORATORY AT BELGIRATE AND THE METHODS PROPOSED BY ALBERTO PIROVANO.

The first Electrogenetic Laboratory was established last June at Belgirate, on Lake Maggiore, at the headquarters of the local Fruit Growing Society. Its object is to obtain new varieties of fruits by applying the methods discovered in recent years by ALBERTO PIROVANO for bringing about what he calls the *electric mutation of plant species.*

The Laboratory, of which a photograph is given of the machine room (fig. 1), was founded with the aid of the Ministry of National Economy, the Province of Novara and the Edison & Conti Electric Company, as well as by contributions from various Corporations and private persons, obtained by the special efforts of the President, Comm. A. FERRAGUTI. This Laboratory which is under the direction of PIROVANO himself is also to have its counterpart at Pistoia, which, as is well known, is a most important centre for fruit culture, and at Rovigo, where Prof. MUNERATI proposes to experiment with similar methods for raising new varieties of beet.

While the attention of practical workers is drawn to the creation of these Laboratories, the results of which cannot however be submitted to public opinion for some years to come, the student will find special interest in the experimental work of PIROVANO either as providing subject matter for future scientific research, or for judging whether the hopes of the practical workers are well founded or otherwise.

The results of his first experiments were set out by their author in a book (1) containing many very clear photographs and engravings ; the later results, which have not yet been published, were observed by the writer in the nurseries at Vaprio d'Adda.

In the matter of genetics, ALBERTO PIROVANO may be said to be perfectly at home. Son of one of the most capable and esteemed nurserymen of Lombardy, a specialist in the production of table-

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(1) ALBERTO PIROVANO, *La mutazione elettrica delle specie botaniche e la disciplina dell'eredità nell'ibridazione.* Milano, Hoepli, 1922, 268 pp., 114 figs. (The figs. are taken from the publication quoted by PIROVANO).

PLATE I.

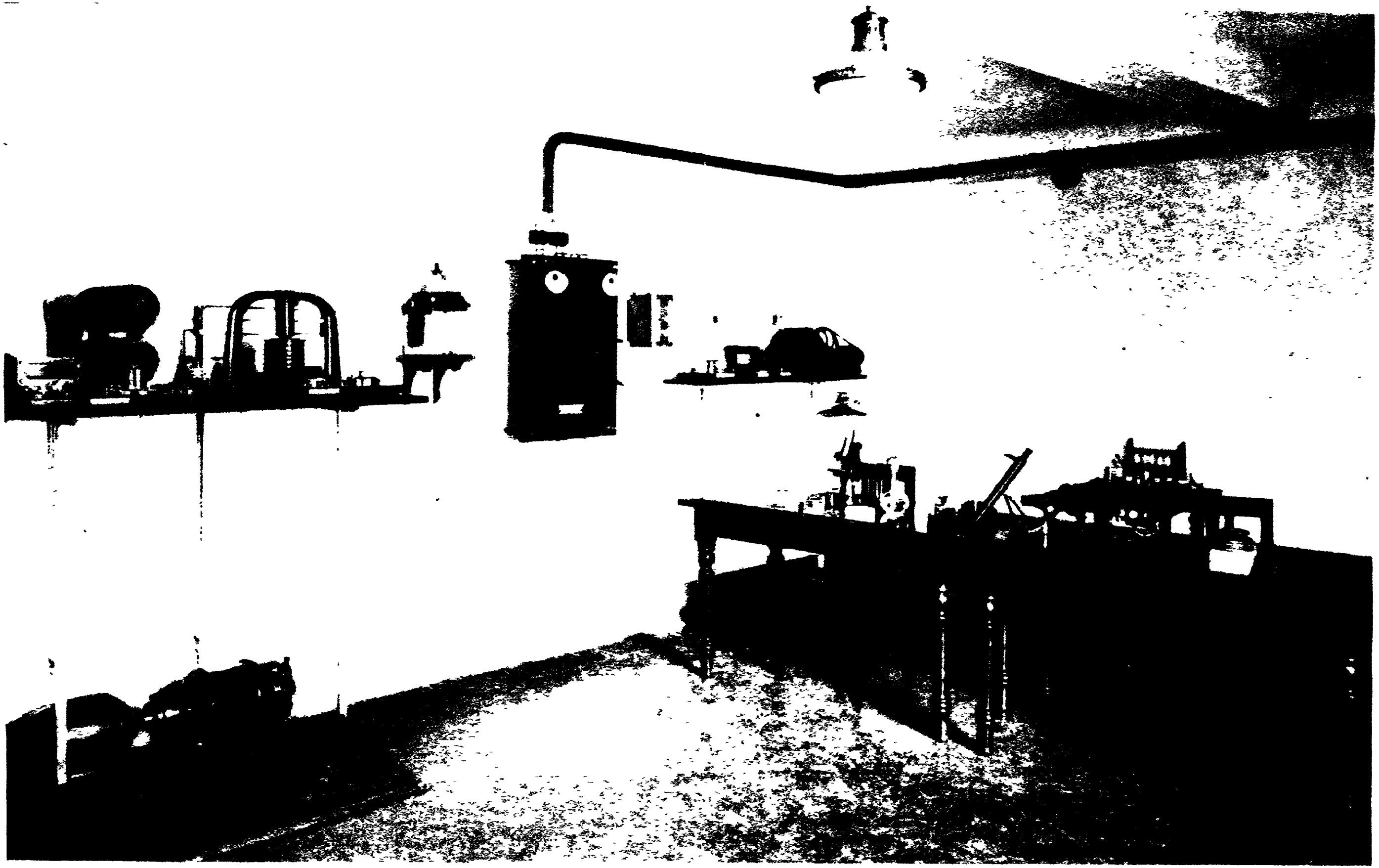

FIG. 1.—Electrogenetic Laboratory at Belgirate.

grape hybrids, he has all the technical knowledge and enthusiasm which lead to success.

He states that in seeking to obtain striking and abnormal varieties, electricity forced itself on his attention as among the most likely means for achieving his object. In view of the difficulties of applying electricity to the female organ, and being also anxious that there should be no hindrance to the nutrition of the embryo which this organ should provide, he thought of applying electricity to the male organ, or pollen, in order through it to produce modifications in the primary cell (the fertilised ovum) from which the embryo originates.

In his book he describes the result of artificial fertilizations produced with pollen subjected in various ways to special electric treatment, causing a fundamental alteration of its constitution. Whatever the nature of this constitution, and it is not necessary here to follow PIROVANO in his speculations on the question, he calls *ionolysis* that alteration or *ionization* which, without killing, is obtained by radioactive or electromagnetic treatment. The forms of apparatus used by him, shown in fig. 1 reproduced above, are various, and may produce various effects.

With the object of subjecting the pollen to the action of radioactive substances, employing radium sulphate, he made use of the apparatus shown in fig. 2 annexed. The pollen must be placed at least ½ cm. from the radiating surface to ensure that the radiation is not too concentrated, but if stronger action is desired it can be placed, for a very short time, in contact or almost so, interposing the aluminium diaphragm in order to intercept the X-rays, which would destroy vitality in a few minutes. The pollen is placed in a thin capsule furnished with a movable septum, and the silver cover to which the radium sulphate adheres and which is attached to a thin ebonite slide R, is immediately placed thereon.

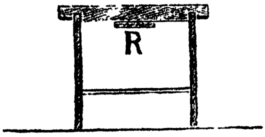

FIG 2 — Apparatus for treating pollen with radium (full size)

In order to study the action of the ultra-violet rays, electric sparks are employed, the test being arranged as shown in fig. 3 annexed, or else the Cooper-Hewitt mercury vapour lamp is used, which is very convenient for ionizing the pollen but should be applied for a very short time.

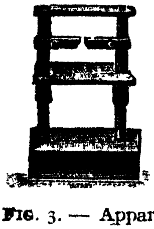

FIG. 3. — Apparatus for treating pollen with ultra-violet rays produced by sparking (1/6 full size).

Ionolysis caused by varying the magnetic field is also very effective. It is always proportionate to the effect induced and is measured by the periodicity of the current and the duration of the exposure. The apparatus used for such application is shown in fig. 4. Two similar coils placed one over the other have a lamellar iron core, well insulated : one is fixed to the base together with its core which it barely touches at 1 ; it is not seen because completely surrounded by the secondary 1-10 mm. copper wire covering A., insulated with silk and coated with paraffin wax. The other, B, may be raised or lowered by turning the lever **M**, which controls the movement by a screw pivoting in a strong cast-iron stanchion firmly screwed down at the base. At C, an alternating apparatus enables the polarity to be controlled at P and P_1 according to the requirements of the case.

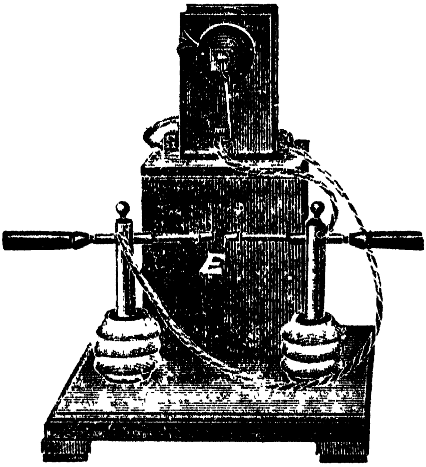

Fig. 5 — High frequency apparatus for treating pollen

Other kinds of apparatus, of which one is shown in fig. 5, are used to bring the pollen under the influence of a high frequency current.

All these applications of current actions are of limited duration and should be *adapted* to the particular species under treatment in which it is desired to bring about genetic modification.

The pollen of various species shows various degrees of resistance. That of the vine, for instance, which is very resistant under preservation is equally resistant to magnetic ionolysis at low tension, while, without losing its fertilizing power, it can no longer produce seed after being exposed an hour and a half to weak ultra-violet rays (fig. 6). Maize pollen also when ionolysed for a long period loses all fertilizing power (fig. 7). These are however exceptional results due to unsuitable or over long exposure to the action of the ionolysing agents, and when the duration or intensity is gradually reduced there are partial abortions, then developed seeds which do not however germinate, then seeds which germinate but give weakly and

PLATE II.

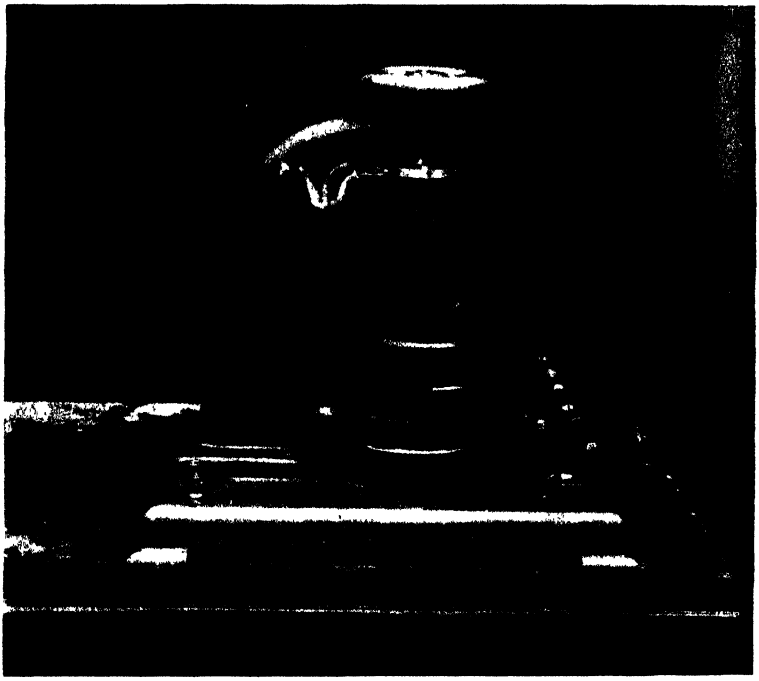

FIG 1 Vertical electro magnet, especially adapted for intermittent currents for treating pollen

PLATE III.

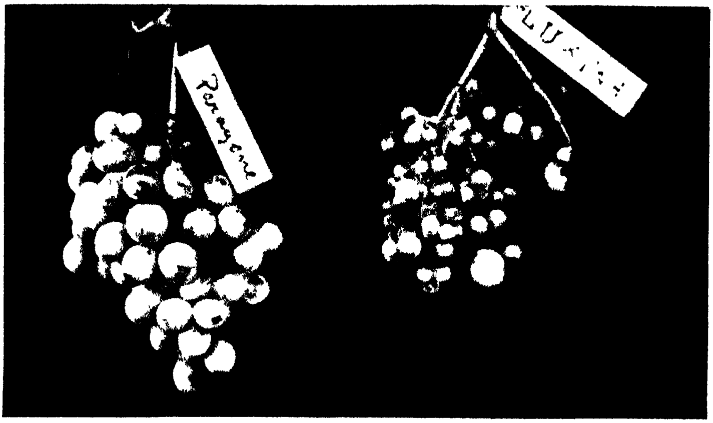

FIG 6 — To the left : bunch of " Maddalena Reale " artificially fertilised with normal pollen

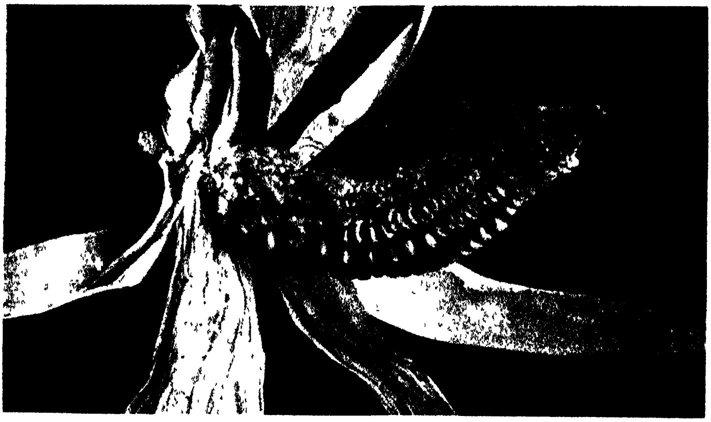

FIG. 7 — Maize

Below : Intermediate products from normal pollen.

Above the pollen, after lengthy ionolysation, has produced semi-abortions.

PLATE IV.

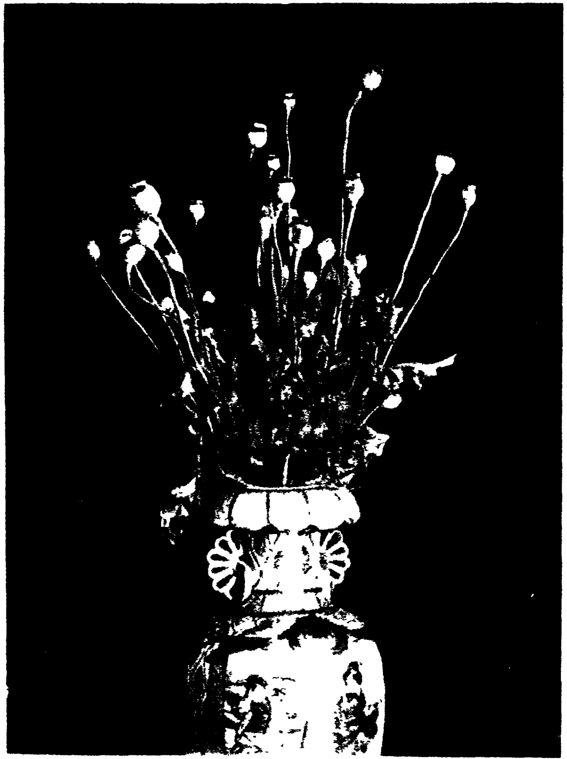

FIG. 8.—Double opium poppy.
(Plant with mature capsule.)

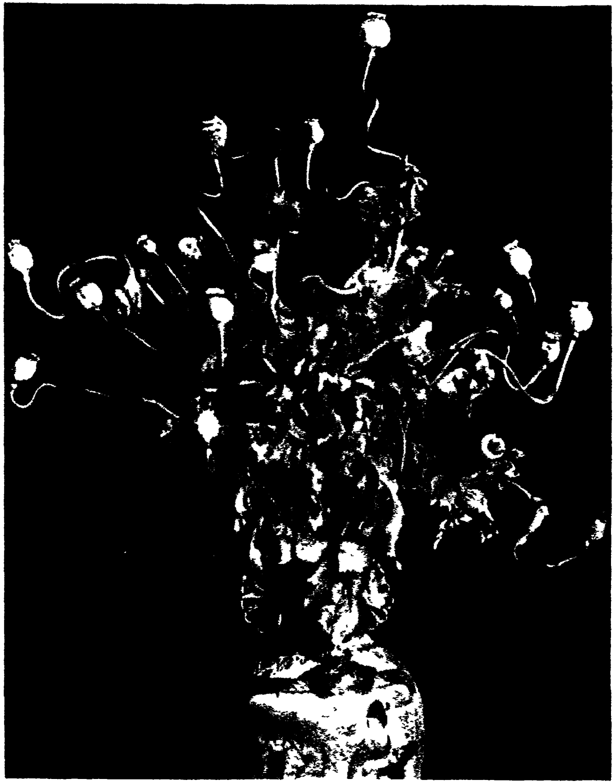

FIG. 9.—Deformation produced by slow magnetic ionolysation for a period of 4 days.

PLATE V.

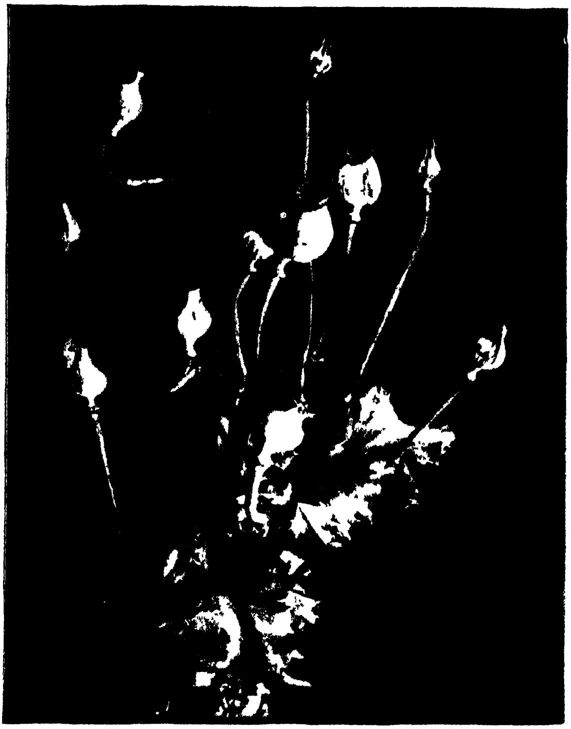

FIG. 10.—Morphological anomaly in capsules produced by irregular, rapid intermittent currents obtained with the electrolytic interrupter.

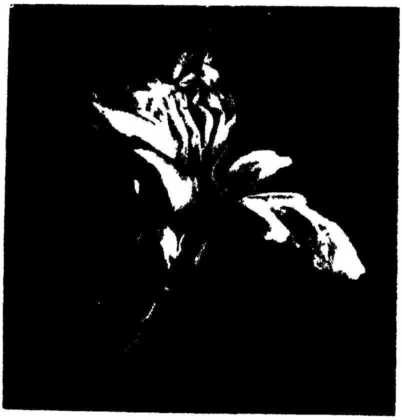

FIG. 11.—A curious carpellary petalloidal phenomenon. From the apex of the ovary capsule, opening naturally, a new and strange corolla appears, after the flowering

PLATE VI.

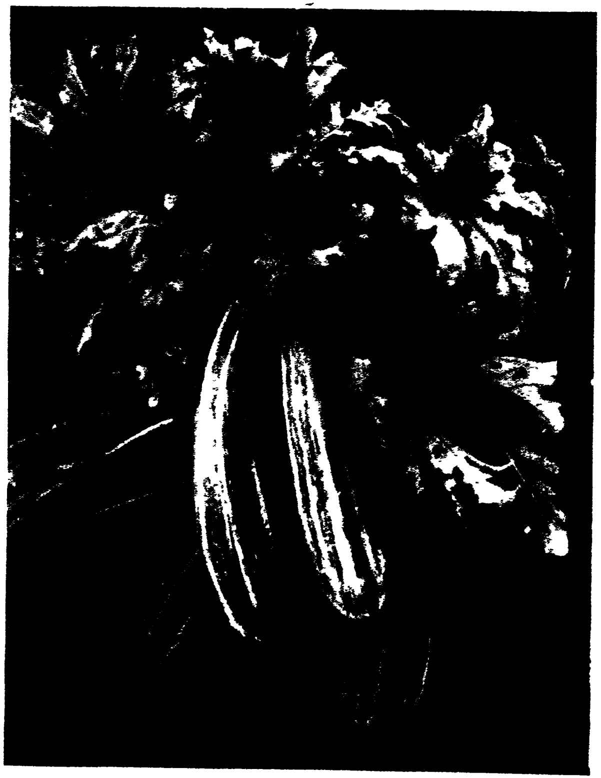

FIG. 12.—The 'Zucchetta d'Italia' 5, a long green marrow.

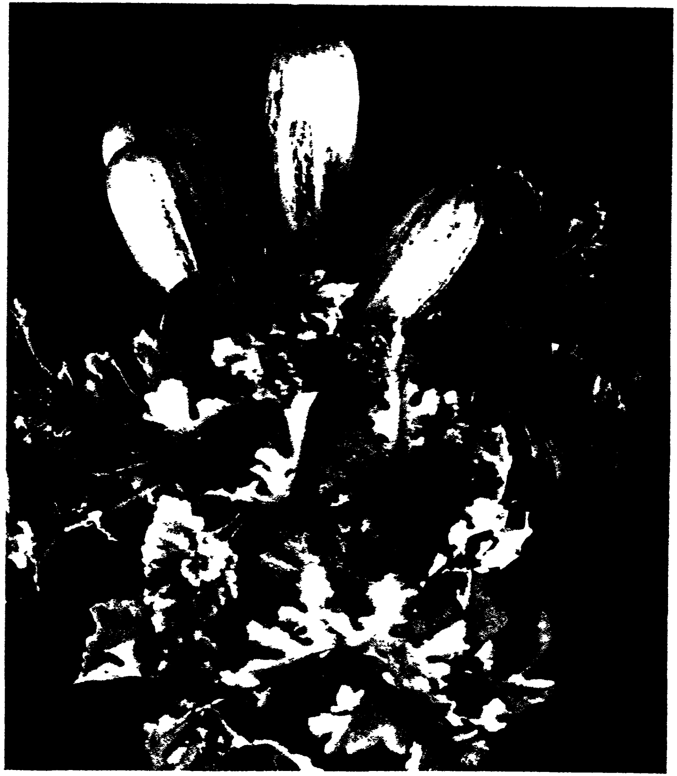

FIG. 13.—The 'Zucchetta d'Italia' shortened, rendered more fertile and yellow by ionolysing at slow periods (1 plant).

PLATE VII.

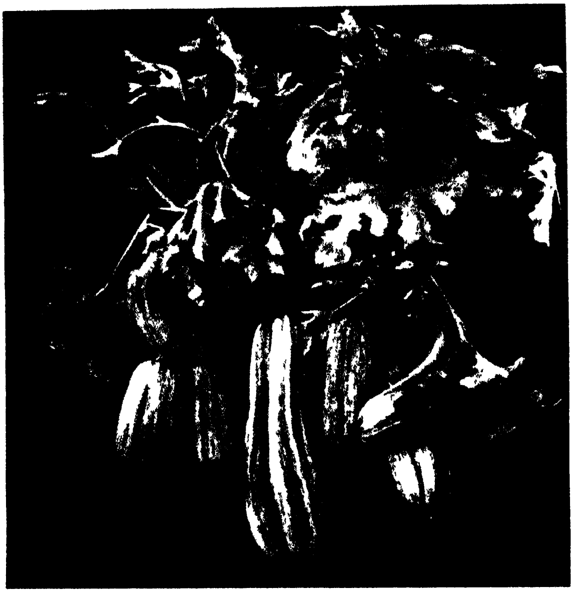

FIG. 14.—Shortening of the fruits of the hermaphrodite plants, and lengthening of the stalks caused by the pulsating magnetic field.

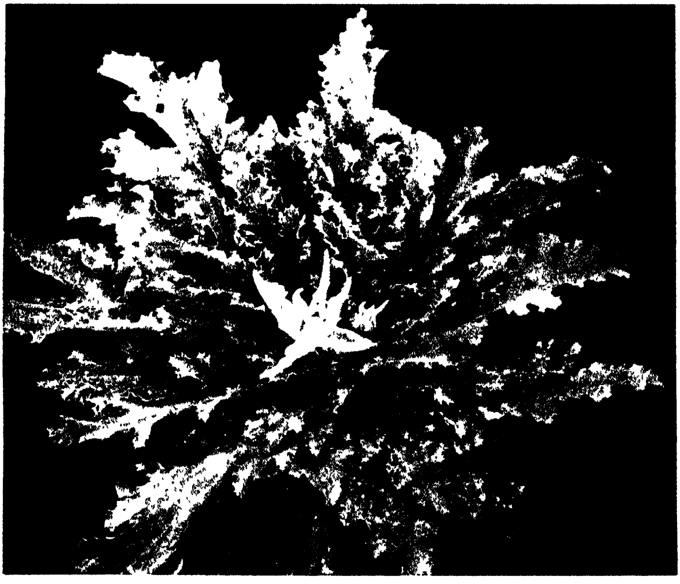

FIG. 15.—A dioecious and stalkless plant, produced by the rapidly intermittent magnetic field (photographed from above).

PLATE VIII.

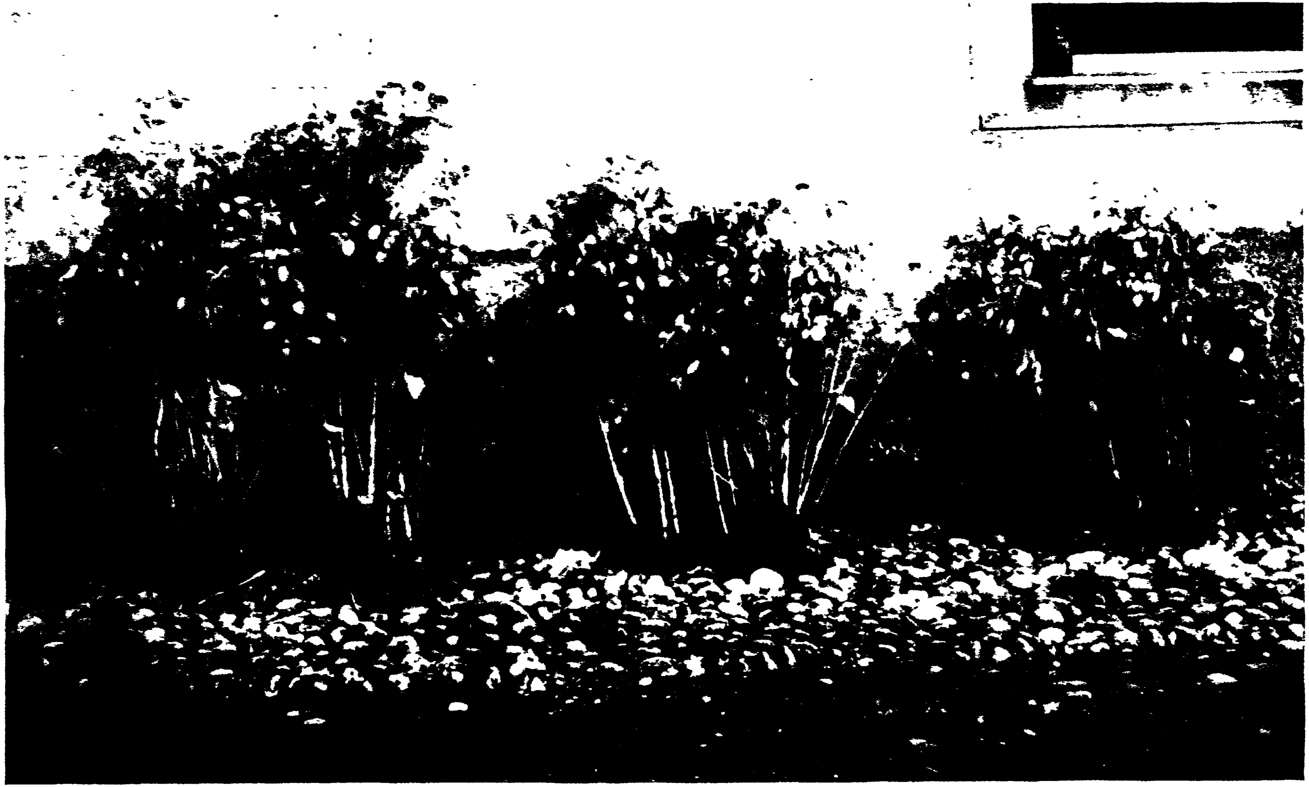

FIG. 16.

A
Lunaria biennis (Patagon).

B
Height reduced by ionolysing at slow periods.

C
Dwarfing produced by ionolysing at 500 periods.

PLATE IX.

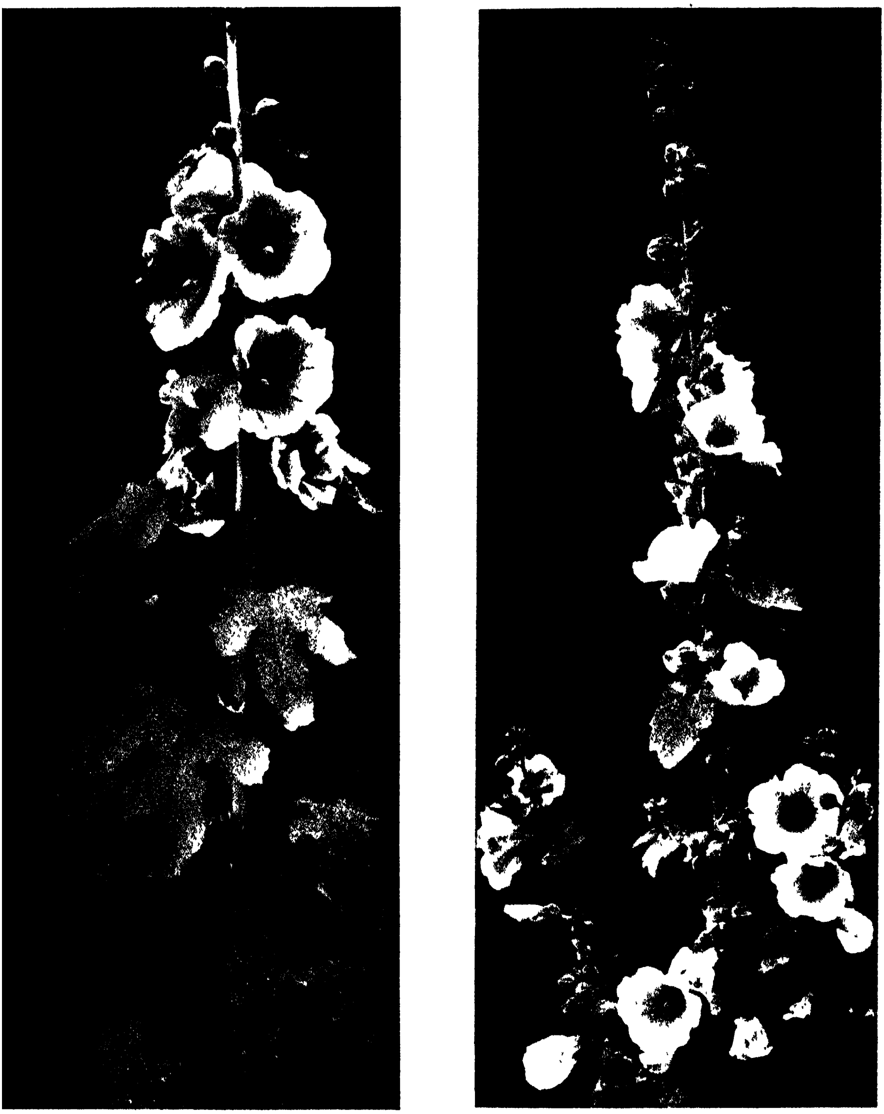

FIG. 17.

Single wild pink mallow (Paragon).

Hibiscoid mallow, which reproduces true from the seed. A form produced by ionolysing at slow periods.

short-lived plants, and finally perfect seeds which give healthy plants, with some variations in their organs.

These last are important and should be discovered by the various methods. Their production depends on a complete combination of most delicate factors, on the choice, proportions and duration of which success depends.

In no other field is testing and retesting so necessary.

PIROVANO's tests have hitherto been made only on annuals: *Papaver somniferum*, *Cucurbita Pepo* and its varieties, *Cucurbita maxima* and its varieties, *Althaea rosea*, *Lunaria biennis*, *Cheiranthus annuus*, *Helianthus uniflorus* and its varieties.

From the tests already made an idea may be formed, as PIROVANO says, of the fundamental variations that may be brought about by the action on pollen of the various agents tested. An examination of the numerous figures in the book and of numerous photographs not yet published, and above all of the material collected at Vaprio d'Adda, suggest that the method is one that may give abundant variations, constant, new, useful or otherwise, expected or unexpected.

Here, for instance (to give an idea of some of these variations), side by side with the normal double opium poppy with mature capsule (fig. 8) there is a deformation induced by slow magnetic ionolysis during a period of 4 days (fig. 9) ; a case of the persistence of petals due to the magnetic ionolysis of the anthers ; a morphological anomaly in the capsule brought about by the irregular rapid interruptions obtained with an electrolytic interrupter (fig. 10) ; and a case of carpellary modification similarly brought about (fig. 11).

Here again, side by side with two normal Italian small marrows (fig. 12), a plant of the same variety which had been dwarfed and is rendered more fertile and yellow by slow periodicity ionolysis (fig. 13) ; one with dwarfed and twin fruits, with long peduncles, obtained by the action of a pulsating magnetic field (fig. 14) ; and one rendered dioecious and stalkless by a rapidly intermittent magnetic field (fig. 15).

Again (fig. 16), by the side of normal *Lunaria biennis* plants are those showing increasingly accentuated dwarf growth induced first by ionolysis at slow periodicity and then by ionolysis at 500 periodicity ; and again two normal mallow plants, to the left, which reproduce themselves properly by seeds, obtained by the new hybridizing methods at low periodicity (fig. 17).

The results obtained with the new methods in hybridization are even more interesting. Tests were made on different varieties of poppies, marrows, tomatoes, sunflowers, altheas, cabbages, maize and peas.

It has become evident that it is possible, by ionolizing the pollen, to weaken at will the genital plasma of the species used as male and thus to displace the predominance in the hybrid of the characters of either parent.

For instance, whereas the hybrid obtained from the double opium-poppy with white flowers, fertilized with pollen from the double variety with scarlet flowers, has pale red flowers with white centred petals, by ionilizing the anthers of the male plant a hybrid with pale pink flowers is obtained, with a small percentage of white flowers, and by a stronger ionolysis, at 100 periods maintained for 6 hours, a hybrid characterised by the absolute disappearance of the red pigment is given.

Another example: by fertilizing the "pasticcina" variety of marrow (fig. 18) with pollen from the "portamantello" variety (fig. 19), a hybrid (fig. 20-*A*) is generally obtained, in the fruits of which the character of the fruits of the male plant may be said to be predominant; and yet if the pollen of the "portamantello" be subjected to from three to twelve hours of magnetic low periodicity ionolysis, hybrids are obtained, in the fruits of which (fig. 20 B and C) the predominance of the male characters is progressively reduced.

Similar results were obtained with tomatoes, maize, sunflowers, etc.

Sometimes the results were of the contrary order, that is, the ionolysis of the pollen brought out the characters of the male parent. These cases are also interesting so far as they are concerned with so-called *false hybridisation*, that is, that in which the male element, through lack of affinity with the female, does not unite with the latter but only stimulates the growth of the ovule; the embryo takes the character only of the species which serves as seed, and the seeds which come from it will give only weakly plants which make poor growth. In these cases the treatments proposed by PIROVANO strengthen the male element and true hybrids may be obtained in place of the false hybridisations.

This may be better explained by an example: *Cucurbita Pepo* var. *melopepo*) (fig. 21) when fertilized with pollen from *C. maxima* var. *aurantiaca* (fig. 22) does not give a true but a false hybrid (fig. 23)

PLATE X.

FIG. 18.—Marrow "pasticcina" ♀.

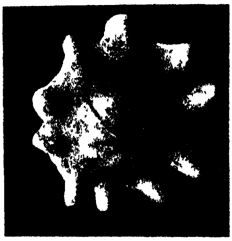

FIG. 21.—Marrow "pasticcina" ♀.

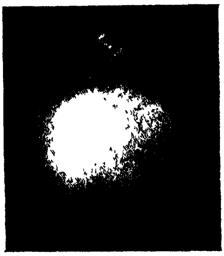

FIG. 22.—Marrow ♂ "Poor man's loaf."

FIG. 19.—Marrow "portamantello" ♂.

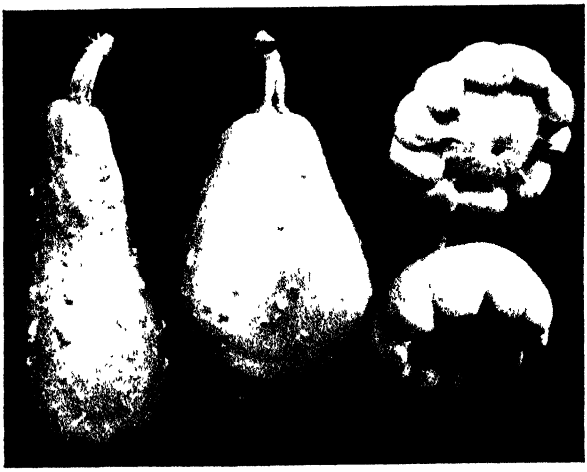

FIG. 20.

A
Normal hybrid.

B
After 3 hours' magnetic ionolysis at slow periods.

C
After 12 hours' magnetic ionolysis at slow periods.

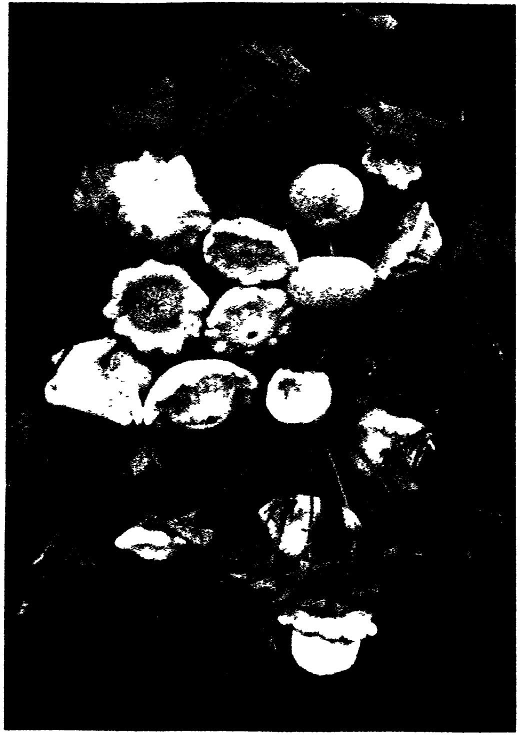

FIG. 23.—Paragon hybrid (false hybridisation) reproducing the maternal species, considerably reduced and atrophied.

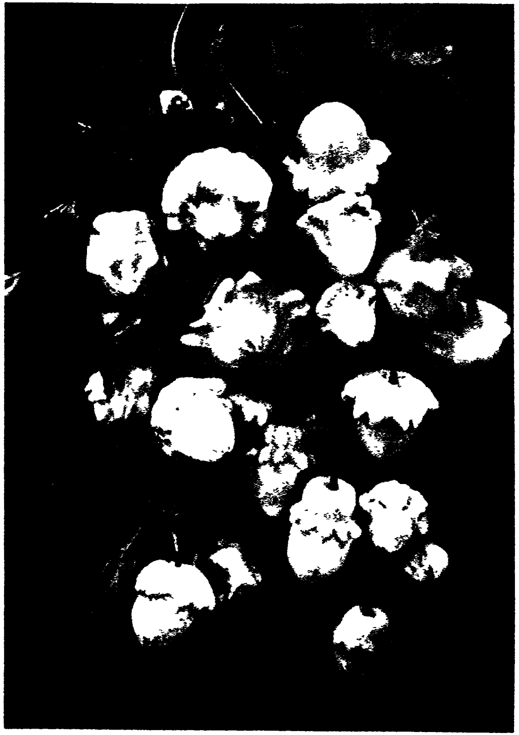

FIG. 24.—The hybrid analysed contrary to the rule, tends towards the male species.

PLATE XII.

FIG. [illegible] Marrow "Italia Paragon" Each plant yields 1-2 very large fruits and hundreds of male flowers

PLATE XIII.

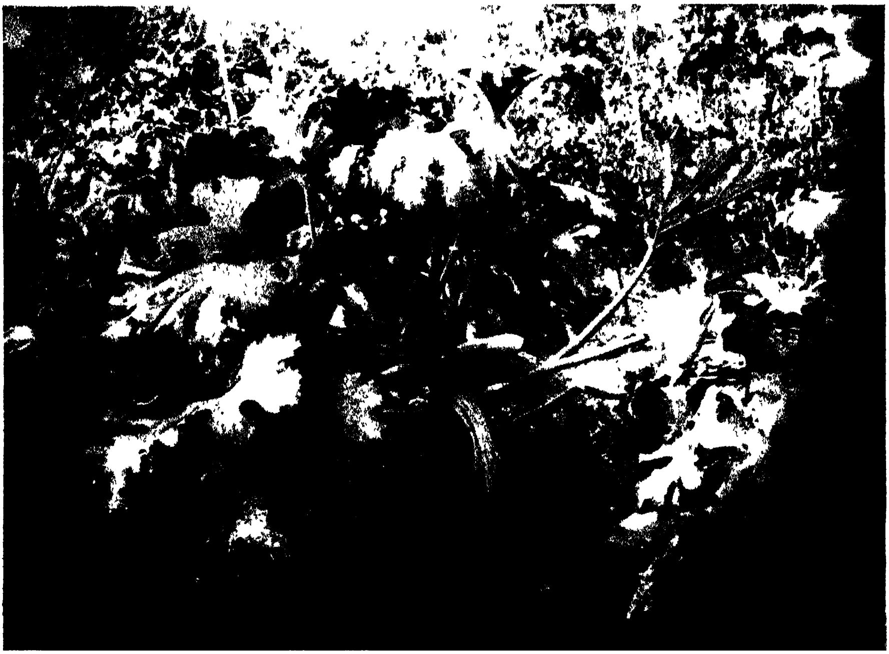

FIG. 26.—F$_2$ from hermaphrodite fruit, obtained in F$_1$ by treating the pollen at 600 periods. Leaves large, few; fruits, flowers and buds, together number 19. The sexuality seems to have a Mendelian character: indeed, the sex male prevails when the pollen is ionolysed.

in which are reproduced, considerably reduced and atrophied, the characters of the maternal species. If on the other hand the pollen of the male species is subjected to an intermittent magnetic field (42 periods) for 3 hours, or to a pulsating magnetic field with a current at 83 volts for half an hour, a true hybrid (fig. 24) is obtained, the characteristics of which are nearer the paternal species than those of the normal hybrid produced with natural pollen.

A final and interesting observation was made last autumn at Vaprio d'Adda. Several beds in which the Italian marrow had been cultivated were literally covered with the fruits of this plant, in such abundance as perhaps had never been observed before.

Normally this marrow gives one or two very large fruits per plant and hundreds of male flowers (fig. 25). By ionolizing the pollen at 600 periods PIROVANO obtained seeds which gave extraordinarily prolific plants, on one of which (fig 26) the fruits and female flowers and buds numbered 19, the male flowers having almost entirely disappeared.

As already stated in another case (fig. 15) the formation of dioecious plants took place, as a result of ionolysis, with the cucumber, which is a monoecious species. In this connection PIROVANO observes that sexuality seems to behave almost as a mendelian character, and in fact as in the majority of hybrids, by the ionization of the pollen the female sex became predominant (1).

What are the conclusions suggested by the above ?

If it is impossible to accept PIROVANO'S hypotheses as to the nature and constitution of the living plasma and the nuclear chromosomes, which is one of the most difficult, most disputed and most obscure problems of biology, and as to the mode of action of electricity, it must be admitted that the results of his experiments are undoubtedly of scientific interest. This interest depends not so much on the production of so many forms, many of them quite abnormal, thus recalling those obtained similarly with certain animals, as on the results whereby varieties, which are normally otherwise, are rendered hybridisable, and on the modification in the hybrids of the distribution of the characters of the parent forms. The influence also shown over the manifestation of either sexual form is deserving of the utmost attention, and the student cannot fail to be interested in the results obtained.

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(1) Mention may here be made of the experience of CIESILSKI at Lemberg, who remarked that in hemp the predominance of the male sex was obtained by pollinating with young and perhaps immature pollen. It would be interesting to see the effect of ionolysis on this pollen.

As regard practical applications PIROVANO himself states that it is as yet premature to make any forecast for the future.

His tests, as has been stated, have up to the present been made only on annuals. Those on fruit-bearing plants were begun this year only at Belgirate, with pollen that he had ionolysed in his Laboratory at Vaprio d'Adda ; it is necessary to wait until the seeds thus obtained develop new plants and see whether and what variations take place which are worthy of being preserved and multiplied or otherwise.

There is here however a new method for creating variations and a careful study of the manner and degree of applying the method to the species may give important results. Such results are specially likely to follow on the treatment of hybrid forms, through which, as PIROVANO affirms, it is more than probable that with suitable means, it may be possible to control in the widest sense genetic heredity and subordinate it completely to the human will.

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Director of the Botanical Institute,
Royal University of Pavia.

VINE-GROWING AND WINE PRODUCTION IN RUSSIA BEFORE THE GREAT WAR AND AT PRESENT.

HISTORY OF RUSSIAN VINE-GROWING.

The history of Russian vine-growing is as singular as the whole history of Russia. Russian wine production, compared with that of Europe, is as new as are the State and culture of Russia compared with those of the countries of old Europe.

The slow development of this industry in Russia is explained by the history of the regions of the South, which may here be recalled.

Russia as a State began to form, little by little, a thousand years ago, starting with the Northern and Central regions.

The last three centuries, the XVII, XVIII and XIX, were the period during which Russia definitely assumed her natural area, pre-indicated by the extent of the great Russian plain, which stretches from the White Sea to the Black Sea and eastward to the boundaries of China, Tibet, Afghanistan and Persia. During the course of these three centuries Russia has increased in extent principally in the south, where the vine flourishes. Previously there was no region for this culture. The history of the South Russian provinces is that of perpetual and permanent warfare between the neighbouring peoples and the various Asiatic tribes which always passed that way in their march westward. The Russian steppes to the north of the Black Sea became deserts after the invasions of the Goths (III century), the Huns (IV & V c.), the Kasars (VII c.), the Prechenegs (IX c.), the Polovtzis (XI c.), the Tartars (XIII c.) and finally the Turks (XV c.) until the colonisation of these steppes by the Russians, emigrating again from the north to the south.

The formation of the Muscovite kingdom, already powerful and populous, enabled these colonisers of the South to establish themselves there firmly, as far as the shores of the Black Sea and the northern Caucasus.

The numerous wars of the Russian Empire with the Turks in the XVII, XVIII and XIX centuries, sustained and fixed them in these new territories. Only in the XIX century, when Transcaucasia and Central Asia were added to Russia, did these southern regions begin to develop their vine growing, which had till then remained in a primitive state.

The regions of the South, especially Transcaucasia, were the universal cradle of the vine and wine production, for Noah, the first man who, according to the legend, fermented the juice of the grape, landed from his ark on Mount Ararat, in Armenia, and commenced to engage in viticulture.

The Transcaucasian vine growers at the beginning of the XIX century had not progressed much in this culture since the time of Noah, on account of the continual wars at this point of passage from Asia to Europe. Nevertheless, primitive viticulture spread there.

In Crimea, Bessarabia and on the shore of the Sea of Azof, vine growing was first introduced by the Roman and Greek colonisers (VII and VI centuries B. C.) and afterwards in the XIII-XV c. A. D. by the Genoese, who taught the natives the care of the vine and wine-making. The domination of the Turks in these regions since the XV c. has completely destroyed this industry on the shores of the Sea of Azof and greatly retarded it on those of the Black Sea.

The Southern provinces of Russia, as they existed in 1924, where viticulture was already extensive at the beginning of the XIX c., were annexed to Russia in the following periods :

Astrakhan	in the XV century
Don	” ” XVI ”
Northern Caucasus (Kuban, Terek, Stavropol)	” ” XVII-XIX c.
Crimea	in 1783
Bessarabia	” 1812
Transcaucasia.	from 1801-1878
Turkestan (Central Asia) . .	” 1864-1885

When these countries were annexed to Russia, viticulture existed in a primitive state in Bessarabia, Crimea, Transcaucasia and Turkestan (only table grapes). In the others only vines reduced to a wild state remained.

The first steps in the development of Russian viticulture properly so called, were made by Czar Michael Theodorovich, at the beginning of the XVII c. at Astrakhan.

Later, when Czar Alexis Michailovich heard that the first Russian colonists on the banks of the Terek (Northern Caucasus) had found the wild vine there, he sent them vine-growers and plants from Astrakhan in order also to introduce viticulture.

In 1720 Peter the Great developed this culture on the Terek by sending Armenians, formerly wine-growers, there as colonists. In 1736 two fortified towns, Mozdok and Kizlar, were founded on the Terek, and with the aid of the Armenian and Georgian colonists vineyards first spread around them and afterwards along the banks of the Terek.

Thus was the interest of the Russian Government in vine-growing first shown. But viticulture did not begin to assume much importance in the economy of the country until the middle of the XIX century. Until then each viticultural region of Russia consumed its own produce and remained in a primitive state as regards labour.

At the end of the XIX century Russia attained its natural limits. Then only, protected from foreign invasion by its military power, did it commence to develop in agriculture and also wine-production. Under the protection of the Great State, safeguarded from the wars and invasions of enemies, the Southern provinces engaged in agriculture, and everywhere interest was aroused in the vine, thanks to a propitious soil and climate.

At the beginning of the XX century, agriculture, the principal and most important economic element of Russia, was already well advanced. The Great War and especially subsequent events have arrested its progress.

It is evident therefore that Russian viticulture cannot have a long tradition of its own nor distinctive types of vines, even in the provinces which have cultivated the vine for centuries.

In the middle of the XIX century when there were not yet enough railways in this vast country, each of the wine-producing provinces, distant from one another, from the Centre and from Europe, retained its own altogether primitive methods of wine-production.

In all these provinces viticulture developed and progressed only after the construction of a railway, which connected it with the crop-growing centres of the country.

The European, and especially French viticultural tradition, then commenced to influence this branch of Russian agriculture. As there were no specialists trained for this work in Russia, the German, Italian, and especially French wine-growers penetrated to these provinces, brought thither on the initiative of the Government and the large proprietors. The first European pioneers in this work were not, unfortunately, the highest specialists of their country, for Russia, considered in Europe as being still too backward, did not arouse the interest of the great wine-producing masters.

At this epoch one often found in Russian cellars or vineyards, foreigners who had formerly been school-masters, barbers, or even cabmen, who gave themselves out as great specialists in European wine production and who directed the work according to their own fancy and made ignorant people believe in their profound knowledge.

Owing to their mistaken proceedings in the beginning, Russian viticulture did not start well. Continued relations with Europe and the great progress made in all branches of Russian agriculture at this time, have however changed viticultural conditions.

Russian literature on this subject has become important. Much sound tradition, mostly French, and several original works by Russian specialists, already trained in this work, benefited and extended the development of knowledge of viticulture and wine production among wine-growers and proprietors, while, in the south of Russia, œnological schools prepared a staff of specialists in this industry.

The first Russian school of viticulture was founded in 1783 in Crimea, at Sudak, and in 1912 it was transferred to Magarach (near Yalta) by the Duc de Richelieu and reorganised. This original school still exists and about the year 1900 became a training school with a sound theoretical and practical course, an œnological station, a cellar and an experimental vineyard.

Another oenological school was founded at Kizlar (in the Terek district) in 1807.

These schools were the pioneers in modern European technique for viticultural work in Russia, but left, however, still much to be desired.

Towards 1914 there were already a dozen œnological training and preliminary schools, without reckoning provisional preliminary courses, wine-growing stations, etc. In Bessarabia and the South-West provinces there were 2, in Crimea 1, in the Northern Caucasus and the Don 5, and in Transcaucasia 4. In several Russian agricultural and technical schools special wine-making courses have been opened. At the school at Magarach, higher courses in wine making lasting two years have been organised. Besides these schools, knowledge of viticulture and wine-production was widely disseminated among the people through the agency of agronomists, specialists at the Ministry of Agriculture, who had formed in the districts of the South, Associations for the introduction of American vine-stocks, œnological laboratories, and temporary courses.

The practical and independent wine-producing organisation of the Imperial Dependencies, which had its vineyards and cellars in nearly all the Russian wine-producing areas and local wine depots in all parts of Russia, was the principal source of information on viticulture and wine production in the Country, owing to the example it set of practical and modern work, perfecting the staff, spreading a knowledge of the technique of the work among the neighbouring peoples, educating the taste of the consumer, and seeking out the typical wine of each viticultural region.

The practical work of the Dependencies and the theoretical and instructional work of the Ministry of Agriculture were the two principal motive powers in the serious development of the work in the Russian vineyards during the course of the last 30-35 years before the Great War.

Many of the owners of private estates, already vine growers and wine connoisseurs, brought their work into harmony with that of the great organisations. The Zemstvos (autonomous administrations of districts and provinces) have also helped much in this development, especially in Bessarabia and Crimea.

At the beginning of the XIX century Russian wines were simply called after the names of the provinces from which they came : the Don, Crimean, Bessarabian, Kakhetian and Kizlar red and white wines. No distinction was made as to vines, and still less as to vintages.

About 1870-1890 the wines began to be subdivided according to the vines, and it became the custom to call them by the names of celebrated European growths : Bordeaux, Barsacs, Sauternes and Rhine wines were sold, which came from all the viticultural provinces of Russia. Doubtless this custom originated with the first foreigners who directed Russian production. Nevertheless, at this time nearly everywhere the French and Rhenish technical methods began to be used more or less efficiently.

Prince M. Vorontzoff was the first great pioneer in this Russian industry, which he improved in nearly all the provinces. Russian specialists perfected themselves in France and on the banks of the Rhine, and the foreign staff in Russia improved. It was already known how to distinguish and choose wines, and Europe began to be interested in Russian viticulture.

Prince Leon Galitzin, a great wine connoisseur, brought up in the French vineyards, began to reorganise the wine production of the Dependencies and of his own estates. His successor was M. A. Merle de Massoneau, a Frenchman and a great wine specialist and first-class taster, who trained an entire generation of Russian wine producers and specialists and directed the whole of the wine-production work of the Dependencies in all the Russian provinces for more than 20 years. He taught them French tradition and technique, educating their taste and perfecting the standard of work. M. Bobiney, a man learned in French wine production, was a collaborator in the Dependencies, directing the work in connection with sparkling wines at Abraou. V. Thiébaut, M. Dravigny, G. Barberou and many other French specialists have contributed their experience and technique to this work. Their Russian pupils, often after a long residence in France, Spain and on the Rhine, and with good practical experience gained in Russia, have become their successors and carry on the best traditions of the wine industry.

Only towards 1890 did wine production in Russia enter into the right channel, directed as it was by the practical wine production organisation of the Imperial Dependencies and the administrative and instructional efforts of the Ministry of Agriculture.

The producers have learnt how to differentiate the various Russian growths. The Dependencies have given special numbers to their wines. Everybody in Russia then knew Nos. 18, 22 and 24 of the Dependencies, which were a definite and constant type, of genuine flavour, well prepared and old.

About 1900, each of the Russian viticultural districts had shown the possible type of its wine. The native growths were then named after the localities producing the best wine of each district.

Throughout Russia the wines of the following districts are known and appreciated: Livadia, Massandra, Aluchta, Alupka, Sudax, Abraou, Anapa, Gelendrix, Naparculi, Tzinondali, Teliani, Muxusani, etc. This was the natural and final object of the elementary development of wine-production technique and of the investigations on original Russian wine types.

In Russia, doubtless, we have no wines corresponding to the great

French growths, but there are certain localities which produce wines of the best quality, correctly treated, full-bodied, with bouquet, bright, and matured in the proper way. The collections of old wines from the Dependencies and other large estates in the Crimea, Georgia and Abraou were a proof of this.

The Russian regional wine type has now been generally found for most of the provinces. Time and continuous work are necessary to make it known and bring it to final perfection. Nor are five or ten years sufficient; it will require decades, and experimental investigation on Russian wine production and the efforts of their French masters to accomplish this work.

We now know, in a general way, what can be done with the vine products in each district of Russia, without trying to reproduce everywhere all the possible types of European wines.

Three fourths of the Russian vineyards were small estates (less than 5 hectares), and one fourth large estates, the pioneers in wine-production technique.

Before 1914 the total value of the production of the Russian vineyards reached the figure of 80 million gold roubles per year. The vineyards produced an average of 2 ½-3 ⅓ million hectolitres of wine.

The export and import of wine in Russia before the war was, in gold roubles:

	1907	1908	1909	1910	1911	1912
Export.	545,983	201,831	187,038	170,802	184,956	53,000
Import.	9,524,918	11,384,163	10,916,317	11,516,095	12,368,522	11,574,000

The exported wines went chiefly to China, Persia and Germany, and gradually decreased, whereas importation increased, in spite of the development in local wine production, this being due to the large increase in the consumption of good wine in the large towns.

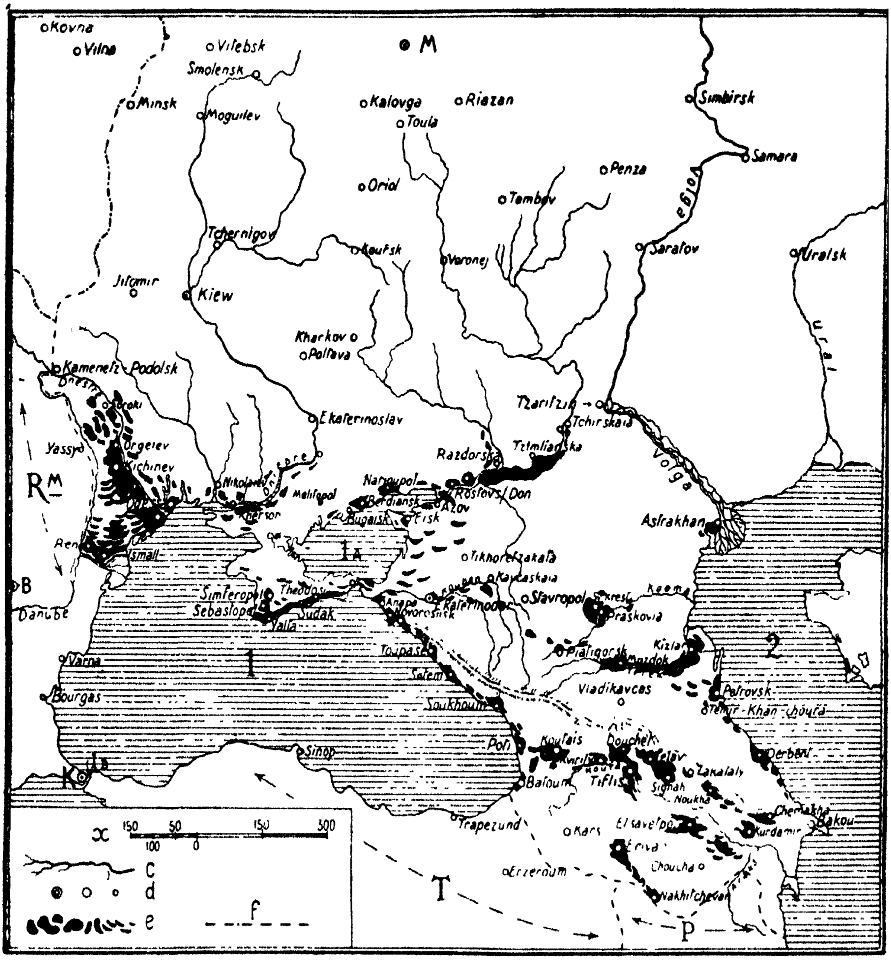

Fig. 27. — Map of Vine Growing Areas in European Russia and the Caucasus.

M = Moscow ; R-M = Roumania ; B = Bucharest ; K = Constantinople ;
T = Asiatic Turkey ; P = Persia ; 1 = Black Sea, 1 A = Azof Sea 2 = Caspian Sea ;
a = Scale in versts (150 versts = 160,002 klm.) ; c = rivers ; d = cities ; e = vineyards,
f = frontiers.

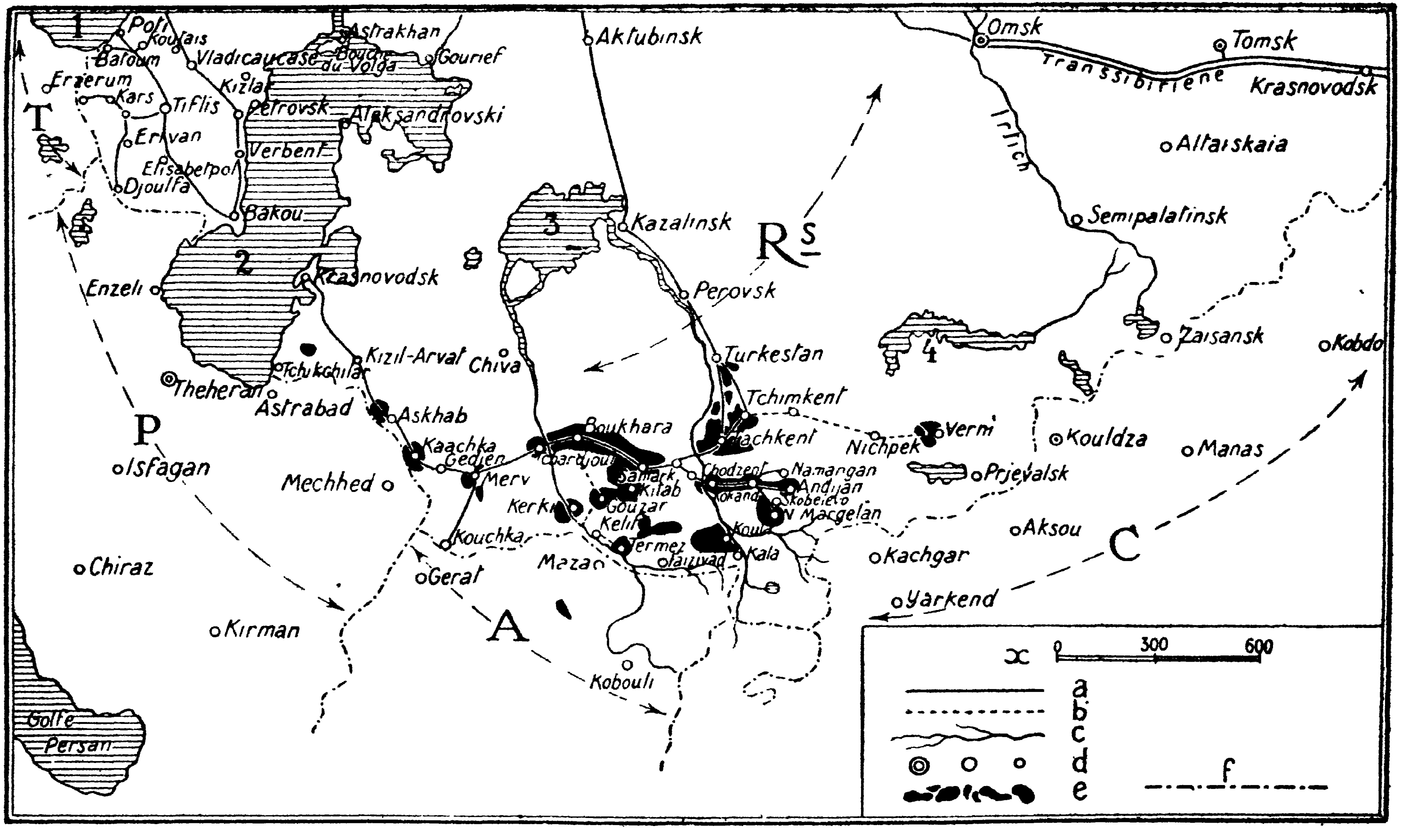

FIG. 28. — Map of Vine-Growing areas of Russian provinces of Central Asia.

T = **Turkey**;. **P** = **Persia**; **A** = **Afghanistan**; **C** = **China**; **RS** = **Russian provinces**; **x** = **scale in versts**; **a** = **railways in exercise**; **b** = **railways in construction**; **c** = **rivers**; **d** = **cities**; **e** = **vineyards**; **f** = **frontiers**.

The production in Russia before the war was, per district:

Provinces	Area of vineyards in ha.	Total grape yield in kg.	Average yield per ha.	Total production of wine in hl.
Bessarabia	66,596	69,800,000	1,120	424,050
Crimea and Ukraine	32,440	59,600,000	2,002	220,962
Astrakhan	552	3,452,000	6,800	369
Northern Caucasus:				
Don	12,580	28.371,200	2,304	77,428
Kuban	8,376	18,331,200	2,400	52,102
Stavropol	5,819	69,065,600	12,928	409,995
Terek	11,825	31,081,600	2,880	186,529
Eastern shore of the Black Sea	950	2,945,600	3,344	20,418
Turkestan	27,391	61,344,800	2,239	29,052
Transcaucasia	84,175	211,776,000	2,515	954,775
Total for Russia	250,704	555,768 000	—	2,375,700

It should be noted that these statistics (from the Ministry of Agriculture) are not exact and are mostly greatly below the actual figures for viticulture and wine production.

In the majority of the provinces it will be noticed that only the smaller part of the grape yield is transformed into wine.

This proves that local wine production has not yet reached its highest point everywhere. As an illustration of this, the following is a table showing the percentage of the grape yield transformed into wine per province:

Eastern shore of the Black Sea	90.1 %	Kherson	47.1 %
Bessarabia	78.8 "	Tauride	46 "
Terek	78 "	Sukhum	43 "
Stavropol	77.2 "	Zaxatali	39.8 "
Daguestan	70 "	Kuban	36.9 "
Tiflis	64.1 "	Don	34.9 "
Erivan	62.7 "	Baku	26 "
Podoli	58.8 "	Batum	16.6 "
Elisabetpol	54.1 "	Samarkand	7 "
Kutaiss	54 "	Kars	5 "
Ekaterinaslav	51.6 "	Fergana	2 "
Syr-Darya	47.5 "	Astrakhan	1.4 "

In certain districts a low percentage shows that the principal production is the table grape (in Baku, Batum, Samarkand, Fergana, Astrakhan), and in the majority of cases implies the local consumption of grapes and household wine. This means that their vine production is too extensive. The Eastern shore of the Black Sea, where the whole of the grape yield is transformed into wine, shows only a normal percentage, 90 %. This is one of the latest Russian wine-producing regions where the work was started on a scientific basis from the commencement, dating from the Russian colonisation after 1865.

THE STATE OF VINE GROWING AND WINE-PRODUCTION IN RUSSIA IN 1924.

The great viticultural district of Bessarabia was separated from Russia and annexed to Rumania (1918).

The other viticultural provinces, with the exception of Transcaucasia, were the theatre of war from 1918 until 1920.

Unfortunately, there are no exact and complete statistics on this question, but the data I have been able to collect give au idea of the present state of this industry in the Union of Soviet Republics now forming Russia.

At the beginning of the Bolshevik regime (1918-1919) the sale and consumption of wine were entirely forbidden, and the cellars containing large reserve stocks were emptied. Only in some places (Fillis, Abraou and the South Crimean shore) did the large depôts old wines remain intact, and these were gradually sold and consumed. The vineyards were abandoned and their area reduced each year.

The civil war was waged chiefly in the viticultural provinces, and this could only have a disastrous effect on the industry. Transcaucasia, the least devastated region, which, until 1921, had been under the autonomous regime of the Georgian, Armenian and Adjerbeijan Republics, more or less maintained its viticulture and wine production. But towards 1923 this industry was destroyed through the ravages of phylloxera, the lack of material for treating the wines and the new economic methods of the Bolshevik régime. In the whole of Transcaucasia, Daguestan has suffered most. According to the data of the Bolshevic Commissariat of Agriculture, wine production in Daguestan fell to one-tenth in the last years before 1921. Near Derbente and Petrovsk the vineyards dwindled away on tens and hundreds of hectares. The Daguestan Viticultural Department states (1921) that after 1-2 years, under present conditions, "*nothing but stumps*" will remain of the local vineyards... (SHEFLER, "The Soviet Central Department of Agriculture and Economics, under the new economic policy". Official edition).

As the economic conditions did not improve towards 1923, it may be estimated that at the present time viticulture in Daguestan has completely perished.

The area of these vineyards must now be deducted from the total area of vineyards in Transcaucasia.

Viticulture in Turkestan towards 1922-23 suffered from the general economic conditions. A Soviet Official Commission which investigated the state of the Province of Fergana in 1923, reported to the Central Labour and Defence Committee as follows. Seventy per cent of the irrigation system existing before the war has been destroyed. Land under irrigation has decreased from 1,068,200 ha. to 343,350 ha. (1/3 of the pre-war area). Even now 80 % of fhe irrigated land is unsown. Only 15 % of the 1917 area of cotton plantations remains. The diminution of labour and especially of livestock (reduced by 58 %) impedes agricultural work (The "*Dni*" newspaper, No. 392, 21 November 1924). Under these circumstances viticulture cannot prosper. The greater part of these vineyards must have perished. In the whole of Turkestan at present scarcely 10,000 ha. remain, instead of 25,000 ha.

The same official publication (Pod redasctiej M. Shefler Centralnoïé Oupravlénié Zemlédelija i Sovietskili Khoziajsfi v sviété novoï ekonomischeskoï polititci Isd. Narodnogo kommissariata Zemlédellija), states: "In 1921 viticulture in the Crimea, the least affected of all the districts, underwent a severe crisis through being unable to dispose of its grapes and wine. It would require an enormous amount of work in organisation and immense sums of money to save this industry from complete ruin and to restablish it as soon as possible over the area it occupied before the war..."

The Soviet newspaper "Sbornik statistitchesko ekonomischeskoï svedenij po sielskotchosiastron Rossin" publishes disquieting data on the years following: towards 1922 the vineyard area in the Crimea had diminished by 1526 ha., and the yield, instead of being 2,400 kg. per ha. as it was in 1916, had fallen so 400 kg. The same paper (No. 89), estimates that the total vineyard area in Crimea in 1923 is 5,450 ha., and that the yield had risen to 1920 kg. per ha. But the selling prices of wine, 2.75 to 3.75 gold roubles per vedro (12.3 litres), were below the cost of production.

As in case of viticulture, all the other intensive crops were equally threatened:

	1916	1922
Fruit-trees . . .	13,625 ha.	10,082 ha.
Tobacco	4,812 "	504 "
yield:	3,360,000 kg.	320,000 kg.

The fruit output was one-tenth (480 kg. per ha. instead of 4,800 kg.). That of 1923 was much better, but exportation could not be organised and the greater part rotted on the spot.

" ... To maintain all these intensive crops in Crimea, *even under present conditions*, a State subsidy of 1 million gold roubles is needed... " (*Economic Life*, No. 89). It is certain that in 1923, there was serious deterioration and reduction of viticulture in Crimea, formerly the most advanced area of Russian viticulture.

In 1921 the Ukrainian vineyards were perishing from the attacks of phylloxera, 3,815 being attacked at that time. (SHEFLER, *ibidem*). The lack of financial means and of a serious campaign against this disease leads to the conclusion that the losses in local viticulture have been still further increased, and at the present time it is estimated that not more than barely 20,000 ha. of vineyards can remain in Crimea and Ukraine, instead of 32,440 ha. before the war.

Viticulture in North Caucasus (the Don Cossack, Kuban and Terek districts and the Province of Stavropol) has suffered during these last years more than that of the other districts. " In the Province of Stavropol in 1920 only 1,000 ha. were harvested... and about 5,000 ha. of vineyards there were not earthed over for the winter and have been frozen " (*Ibidem*).

In 1922 viticulture completely perished in the Province of Kuban. There remain only small areas under the grape, utilised for domestic purposes. Vineyards are also diminishing in the Black Sea Coast Province. Soviet statistics furnish the following figures (" *Economic Life* ", 15-III-23):

	1912 ha.	1922 ha.
Kuban	7,194	—
Shore of the Black Sea . . .	2,158	981-566

Of the 981 ha. still remaining in the latter province, only 566 ha. are cultivated and productive.

The total area of Soviet vineyards, according to my calculations, in 1924 is:

	Before the war — ha.	in 1924 — ha.
Transcaucasia	84,175	80,000
Turkestan	27,391	10,000
Crimea and Ukraine	32,440	20,000
The South-East (North Caucasus, Don, Astrakhan and Stavropol)	40,102	13,000
Total	184,108	123,000

That is to day, the general area of Russian vineyards has diminished 33 % on pre-war figures.

The Soviet data which on the whole correspond with my estimate and only vary in details, show a still higher percentage of loss.

At the Exhibition of the Federation of Soviet Republics held at Moscow in 1923, official figures were published showing the vineyard area per province in thousands of ha.:

Provinces	Before the war	in 1922
Ukraine	34.8	4.3
Crimea	9.2	2.6
Don	13.0	4.3
Turkestan	24.0	21.4
Astrakhan	1.0	0.3
North Caucasus and Daguestan	28.7	17.0
Transcaucasia	105.7	85.0
Total	216.4	134.9

About 1922 81,500 hectares perished, being 37.5 % of the total vineyard area.

There is no doubt that this loss is rather under than over-estimated and by 1924 has undoubtedly increased owing to the ravages of phylloxera and to the state of the agricultural economy of the country.

The present vineyards as shown by these figures are not in a normal state. Vineyard area and cultivation have much diminished in recent times. A low estimate would give 50 % only as being in a normal state, the others having lost most of their quality and especially their fruit-bearing capacity.

We see, then, basing on the Soviet figures, that the remaining vineyards in Soviet Russia should be divided into two classes :

fruit-bearing.	67,800 ha.
abandoned and new (or restored) . .	67,800 "

The book already quoted (SHEFLER, *ibidem*), gives a general idea of the situation of Russian viticulture about 1921 : " ... The war, the blockade and the abolition of the wine trade have greatly harmed agricultural economy, and especially viticulture and wine-production. " The prohibition of the sale of wine, its expropriation at a fixed price or even without payment, and, in some places, the absolute prohibition of wine-production, have placed the growers in an inextricable position, for they depended financially solely on the sale of wine to the State and to private buyers. There remain neither financial resources nor other means to continue this industry. The bitter civil war in these regions still further increases the ruin of viticultural production " (*ibidem*, page 96).

This official publication of the Commissariat of Agriculture suggests a project for the restoration of Russian viticulture. Recalling and approving of " the work done by the Dependencies and the former Ministry of Agriculture, for the improvement of Russian wines "... this Commissariat finds that " with great energy and State aid, wine production in the Soviet Federal Uhion can yield at least 2 ½ million hectolitres of table wine per annum, which will be sold on the home market "... " During the capitalist period of the industry until 1918, the organisation of wine production took the form of ' a productive, commercial combination '. This is quite comprehensible. Neither can the State now evolve any other system for the restoration of this industry in view of the technical conditions of this work " (*ibidem*). The free sale of table wine was authorised by the decree of 9 August 1921. This helped to improve the position of viticulture. But private capital could not come to its assistance.

" With a fluctuating exchange it cannot be hoped that private capital can be obtained... The State itself must aid the growers by procuring them material and implements, and by organising the sale of wine "... (*ibidem*, p. 99).

The plan proposes to organise the purchase of grapes and new wine by State organisations and to improve the plants by more productive varieties.

This work should be concentrated on the large estates expropriated by the State, with their cellars, plant and vineyards, which were formerly exemplary.

For the benefit of the State, the Commissariat in 1921 proposed to tax each bottle of wine 25 gold kopeks ($^2/_3$ of a French franc), in order to raise 60 million gold roubles a year from wine excise. The general plan above-mentioned is being carried out as regards the wine-production of the Soviet Union.

By the decree of 26 August 1920, the Commissariat of Agriculture was placed in control of all wine-production, following the initiative of the former Government, extending its programme, : " Government operations in viticulture should take the authorised form of single control ". " The Commissariat of Agriculture should organise a single institution, which would, immediately and resolutely, begin the work of saving and restoring the financial resources, which the viticulture and wine production of the Union can and must assist, on the basis of the realisation of the wine loan by the sale of this product " (SHEFLER, *ibidem*).

It was on this basis, it appears, that a wine-production syndicate was organised in 1921. It unified the greater part of the former large viticultural estates and wine-trading firms. It plays the chief part in the whole of the viticulture of the Union.

In 1923 the Wine Syndicate investigated the spread of phylloxera in Transcaucasia, North Caucasus and Ukraine. It found that the vineyards must be restored everywhere by grafting American stocks. But the lack of this material is evident. Before the war American stocks were imported from abroad, for the Russian nurseries were not yet sufficiently numerous. At present not more than about ten are left, having an area of only 100 ha.

The Wine Syndicate proposes to increase them to 500 ha., to start with, in 1924. To do this it needs 1 ½ million gold roubles, without which it finds it impossible to restore the vineyards and ensure the development of wine-production (" *Economic Life* ", No. 27, 1 November 1923).

The financial situation of the Soviets will doubtless be the decisive factor in this restoration. In July 1923, at a session of the Commissariat of Agriculture, the Wine Syndicate presented its report of the state of viticulture in the Country (" *Nakanunye* " No. 403, 7 August 1923). The vineyard area is estimated at 137,078 ha. though (this figure may be rather exaggerated). Of this the State owns only 64,469 ha., or 47 %. Some of the Soviet properties do not come under the Wine Syndicate and remain autonomous. Owing to the general measures adopted by the Wine Syndicate for improving viticulture, in 1923 a total yield of 31,661 hl. of wine was expected, i. e. twice that of 1922.

The more favourable weather conditions cf the year no doubt played an important part in the basing of this estimate.

Apart from the exploitation of its own vineyards, 4 million kg. of grapes and 20,295 hl. of new wine have been purchased up to the present from the small proprietors, mostly in the regions of Kakhety and Elisabetpol. The wine is sent to the large cellars (formerly those of the Dependencies and private estates) which have up to the present remained empty.

The Wine Syndicate is especially trying to take measures against vine diseases and parasites by supplying the growers with the necessary materials and machinery for treating the vines. It finds that this work can only be successfully developed by the aid of a loan. In 1922-23 the Syndicate advanced to the local winegrowers' unions a sum of 422,934 gold roubles.

These projects of the Wine Syndicate were accepted by the Commissariat of Agriculture as a working scheme, and Russian viticulture and wine-production is at present being organised on this basis. Thus we see that the large Russian viticultural estates and their technical apparatus, are again beginning to be restored and organised on a basis which serves as a model to the whole of Russian viticulture.

If the finances and economic policy of the Soviets permit, this general plan of wine-production work must be considered satisfactory and should gradually restore in Russia, this industry so backward for the moment.

It is evident that this plan, the only possible one under present conditions, is due to the persevering work and technical knowledge of the Russian specialists working in the Soviet territory.

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Kingdom of the S. C. S.

VINE-GROWING IN ROUMANIA.

HISTORICAL REVIEW OF VINE-GROWING IN ROUMANIA.

The cultivation of the vine in Roumania goes back to such a remote period that it is not possible to give any exact information as to its origin.

The Romans who came to Dacia found the latter a flourishing state, and gave it the name of " Dacia felix ".

Decebal, King of the Dacians, considered wine a drink of honour and drank it from an aurochs' horn covered with gold. After being conquered by Trajan he broke his sword and then drank a last cup of wine into which he had put poison, in order not to submit to the shame of yielding.

Long before the Christian era the Dacian king Boerebista had ordered the vineyards to be destroyed, without however, according to Strabo, succeeding in getting his order obeyed.

The Scythians, who came to these regions before the Dacians, possessed extensive vineyards and were in the habit of drinking wine pure, unmixed with water ; the observance of this custom, to which he was not used, cost Cleomenes, King of Sparta, his life (1).

Our ancient forests still contain old *vitis silvestris* bushes, clinging like strong creepers to the neighbouring trees and producing tiny grapes with little black seeds, which the peasants call " Laurusca ".

AURELIAN FELIX is right in maintaining that from the earliest times Roumania has been considered the natural home of the grape.

Our wines are of very old renown. As far back as 600 years before the Christian era, an extensive local wine trade was carried on by Greek sailors on the shores of the Black Sea (2).

The Genoese also carried on this trade from the time of their activity in this region. The Romans themselves adopted as an emblem for the city of Tomis (now Constanza) a grape, and this symbol was also struck on the coins and reproduced on terra-cotta ware (1).

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(1) G. N. NICOLEANO. Introduction à l'Ampelographie roumaine (Introduction to Roumanian Ampelography). Bucarest, 1900, p. 37.

(2) L. PORTES and F. ROUYSSEN. La vigne en Russie (The vine in Russia), (p. 2).

The Roman legions, on entering Dacia, introduced new varieties of Italian and Greek vines, technical terms, and special cultural and wine-making methods, which have survived up to the present day with their original Latin names, which are easily distinguishable from the Slav and Dacian terms.

In the course of centuries our viticulture has undergone very serious and sometimes catastrophical crises, but has always recovered without losing any of its fine qualities.

Princes and dignitaries of the country, possessing rich and fine vineyards, have always been found at the head of those whose efforts have been directed towards the reconstruction of the viticultural regions.

Roumanian wines have always been highly appreciated, not only by travellers and visitors from abroad, but also by scientific specialists such as Franz Sulzer (1871), Thomas Thornton (1826), Neugebauer (1854), W. Hamm (1886), etc. (2).

The wine-trade was carried on in ancient times on a large scale with Russia, Poland, Hungary, Austria etc., which countries regularly imported Roumanian wines, and at one time also large quantities of wine for many years were sent to France (3).

It is also to be noted that Cognac brandy made in Roumania, at Ilmeni and Berheci by the firm of Naville and Co., was sent to France, hence it afterwards became known all over the world (4).

The Roumanian wines were comparable to the similar French growths (Chablis, Bordeaux or Champagne) (5). M. Muillefert compares them to the Hungarian or Rhine wines, and others to the Roussillon (6).

In 1711, Peter the Great, Emperor of Russia, much appreciated the Cotnari wines, and recognised their quality (7). Before

(1) Collection in the museum at Constanza and collection of Prof. W. Knechtel

(2) Quoted by Dr Ch. D. Drutzo. Etude sur la Viticulture et les vins de Roumanie (account of Roumanian Viticulture and Wines). Bucharest, 1900

(3) V. C Munteanu and C Roman. Les vins de Roumanie (Roumanian wines). Bucharest, 1900, pp 296-301

(4) *Pester Lloyd*, Budapest, No 356, of 24 December 1890. Quoted by V. C. Munteanu and C. Roman.

(5) Etienne Fould, consul at Paris. *Rapport du* 15 *Novembre* 1889, quoted ibidem.

(6) P Muillefert *Les vignobles de France et de l'étranger*. Paris (p. 408).

(7) *Le chroniqueur Neculcea. Chroniques II*, quoted by M. Cogalniceano.

railways were yet heard of, Roumania exported large quantities of grapes, fresh, or dried by a primitive local method (1).

The bouquet of the Cotnari, Magura (Dragashani), Piatra and Nebuna wines, which W. **Hamm** considers similar to that of the Sahtoni wine, but stronger, was known in the large cities of Western Europe, and was as much appreciated as that of the Tokay, Malaga and Rhine wines, etc. (2).

Our viticulture has suffered great disasters :

a) *The Barbaric invasions*, which lasted more than 100 years.

b) *The attacks of phylloxera* (1884-86) which almost completely destroyed the old vines.

c) *The world war*, which caused enormous loss and injury, both from the occupation by the enemy and the destruction caused by the Russian Bolshevik troops, and from the economic crisis which resulted therefrom.

The losses caused through occupation and destruction are already a thing of the past, and it is believed that the end of the present viticultural crisis has now been reached ; it is hoped that the restoration of the vineyards, which has been delayed for years, will now begin, together with the economic recovery of all the branches of agriculture and industry in our country.

The Wine-growing wealth of Roumania.

The enquiry undertaken by us personally, during which for three consecutive years every wine-growing region of the country has been visited, has led to the following conclusions (3)

Roumania at present possesses about 250,000 hectares of vines. Bearing in mind, however, that many vineyards are wholly or in part uncultivated and that these gaps have not been made good owing to the war (they form about 10 % of the total area) ; taking into consideration also that others are formed of still young vines, giving no yield, it is estimated that there is a total producing area of about 200,000 hectares.

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(1) **Martian** *Annales Statistiques pour les années* 1861-1868 Quoted by V C **Munteanu** and C **Roman**

(2) W. **Hamm** Das Weinbuch. Leipzig, 1883, (p 478)

(3) I. C **Teodorescu** Organisation de la production et de la vente dans l'industrie viticole Communication faite au congrès agricole général de Bucarest le 5 fév, 1924 (Organisation of production and sale in the viticultural industry Report to the General Agricultural Congress at Bucharest, 5 February 1924).

The following statement shows the position of these vineyards:

a) *Quality of wine produced.*

10,000 ha. (5 %) of vineyards produce *very superior* table wine
110,000 » (55 %) of vineyards produce *good* table wine.
80,000 » (40 %) of vineyards produce *ordinary* table wine.

b) *Annual production.*

10,000 ha. of vineyards produce an average of 18 hl. per ha. per year, total 180,000 hl.
110,000 » of vineyards produce an average of 35 hl. per ha. per year, total 3,850,000 hl.
80,000 » of vineyards produce an average of 42 hl. per ha. per year, total 3,360,000 hl.

Annual average: 200,000 ha. of vineyards produce an average of 31.66 hl. *i. e.*, a total of 7,390,000 hl. of wine.

c) *Value of annual yield* (based on average prices in 1923).

a)	180,000 hl.	superior wine	at 1400 lei per hl.	252,000,000 lei
b)	3,850,000 »	table	» » 900 » »	» 3,465,000,000 »
c)	3,360,000 »	ordinary	» » 600 » »	» 2,016,000,000 »
Total . .	7,390,000 hl.	wine	at 966 lei per hl.	5,733,000,000 lei

(1 *lei* = 1 *franc at par*)

d) *Average cost of production of crop throughout the country.*

	Lei
a) *Labour*: 200,000 ha. at 235. 3 days work per ha. 47,060,000 days at 45 lei	2,117,700,000
b) *Material* etc. at 3500 lei per ha.	700,000,000
c) *Rent* at 800 lei per ha.	160,000,000
d) *Plantations and Buildings* at 3500 lei per ha. . .	160,000,000
e) *Direct Excise on wine* at 75 lei per hl.	554,250,000
f) *Expenses of Management* at 2000 lei per ha. . .	400,000,000
g) *Annual Interest on Working Capital* at 2000 lei per ha.	400,000,000
Total annual expenditure . . . Lei	4,491,950,000

e) Annual Net Profit on the Working:

Average value of crop	5,733,000,000
deduct annual cost of production	4,491,950,000
Net Profit . . . Lei	1,241,050,000

or 6,205.25 lei per ha. per year.

Note: The above figures are deduced from the totals of all the calculations. There is a curious phenomenon in Roumania, however: the better class vineyards, producing the finer wines, scarcely yield any profit; they are not a financial success because the cost of production is higher than the value of the crops. This is due to there being no exportation; there are few buyers of choice wines, and so the vines giving large yields are much more remunerative and more sought after, whereas those of superior quality only continue to exist owing to the connoisseurs.

The Vine-growing Areas in Roumania in relation to Growth and Quality of Wines.

Roumania, within its ethnological and natural boundaries, occupies an area of 298,000 sq. kilometres and is situated on the great mass of the Carpathians, which divides the country into two nearly equal parts. On either side of this chain of mountains all the rivers of the country flow down and afterwards unite again and discharge their waters into the Danube and the sea.

All the hills lying below the Carpathians and the higher banks of these water-courses are partly laid out in with vineyards, generally up to a height of 300 metres until they attain their extreme northern limit at 47.6° N. latitude. The Magura Shimlaului vineyards only, situated at 47° N. latitude, are at a height of 550 m. and form a very interesting exception.

The wine-growing character of these regions depends on the climate, the nature of the soil and the varieties cultivated. However, as there is a great variety of soils, the effect of which is only shown in certain special localities, the most important factor which determines the quality of wine, the system of cultivation, the method of pruning and even the number of varieties, is in all cases the climate.

The Roumanian vineyards generally belong to two zones having quite different climates:

1) *The vineyards of the temperate climate* are characterised by the fact that the vines situated on the hill-slopes survive the winter without being earthed over; the varieties of the third period of ripening (Pulliat classification) may also succeed; red wines may acquire a rather good colour; in exceptional years sweet wines may even be obtained; finally, the form of pruning may be maintained and carried on regularly. In general this climate necessitates a mixed pruning, known under different names, which consists in leaving one or several productive shoots and one or two stocks.

The majority of the Roumanian vineyards belong to this climate; the most numerous varieties are met with in this zone, among which table grapes succeed best. The period of growth lasts from 200 to 210 days.

The rainfall is more or less regular (500-550 mm. per ann.); but the autumn is nearly always calm, dry and rather long, and the white frosts come rather late. The ravages of phylloxera and cryptogamic diseases, especially mildew and oidium, are more severe here than in the following region.

2) *The vineyards of the cold climate*, situated almost on the extreme verge of the zone of cultivation, have the distinctive character that the plants can survive the keen frost during the winter without being earthed over; there are however exceptional years (1924) in which many shoots perish even when earthed over, especially the yearlings, the stock growing up again from below. This is why the vines in this zone are generally earthed over, and the form of pruning is that of the so-called " Moldavian ", with old shoots, long and trained very high, in " umbrella " form.

In this climate the varieties of the III period of ripening do not succeed or only in exceptional cases and in quite favourable exposed positions. The number of varieties is limited, this being especially due to the cold, rainy autumns and to the early white frosts. The period of growth lasts on an average 180-190 days.

In this northern region scarcely any but white wines are made, light, agreeable, but often very sour. Sometimes the vines are protected against the spring frosts by smoke clouds. The varieties of the I and II period, with a thicker skin, are recommended; the muscatels have a very pleasant aroma.

Many native vines are still found here, phylloxera being slow to attack this region, contrary in this respect to the others.

Scarcely any disease other than mildew is met with here : oidium is very rare and its attacks are slight in intensity.

NATURE OF WINE-GROWING SOILS.

The nature of the most renowed wine-growing soils is very varied.

1) The celebrated Cotnari vineyards (Dept. of Iassy) are situated in Upper Sarmatia (Miocene) in Moldavia, on a clay-sandy soil, rich in fine gravel with lime concretions in the proportion of 20- 30 %.

2) The vineyards on the Dniester terraces (Bessarabia) grow on an ancient (Tertiary) cretaceous soil rich in shells, covered with light layers of clay mixed with sand.

3) The Codru district (Bessarabia) which contains the best vines under the northern climate, has a forest soil with a thick layer of chernozem, very rich in humus.

4) The famous Cetatea Alba vineyards (Bessarabia), like those of the Mihai Valley in the Theiss plain (Transylvania) grow in hot sands, ancient dunes, producing fine and delicate wines which recall certain years of the Sauterne wines.

5) The well-known Dragashani vineyards (Oltenia) where the best wines, almost sparkling, are obtained, grow on slightly ferruginous yellow sand, containing a large proportion of small gravel and some lime nodules.

6) At Minish (Dept. of Arad) in Transylvania, the famous liqueur wine known as " Minis " (1) is obtained with the local variety " Cadarca neagra ", in vineyards planted on the diorite rock terraces on the spurs of the western Carpathians.

7) The Alba Julia and neighbouring wines which have the most marked bouquet, are produced from the " Feteasca " variety, planted in a soil formed of marly schists (bed rock exposed).

SOME WELL-KNOWN ROUMANIAN VINEYARDS.

It is very difficult to classify the Roumanian vineyards according to the wine types produced in the different districts.

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(1) Wine prepared like Madeira, Sherry, etc. (Ausbruch).

The most important localities, per province, are therefore given:

1) *Bessarabia*

The best vineyards extend along the Dniester terraces, their only speciality is red table wines, among which the *Shaba, Cetatea Alba, Purcari, Tighina, Speia* and *Saharna* hold the first place.

Towards the North-West, in the interior of the province, are the "Codru" vineyards, which produce choice wines at *Taleshovo, Romaneshto, Cazaneshti* and *Vascautzi*; the vineyards at *Calarashi, Strasheni, Tzeleneshti* and *Bucovitz* are cited as vineyards of extensive production.

In the centre of Bessarabia the best wines are produced at *Kishinau, Leontievo, Vadullui Voda, Miciuca, Bolboca, Pojèreni, Tighina, Caushani, Comrat, Costeshti, Cojushna, Nisporeni*, etc.

South Bessarabia produces some very fine wines; besides the vineyards already mentioned at *Shaba* and *Cetatea Alba* on the banks of the Dniester, the centres of production in this region are *Tziganca, Bolgrad, Borceag, Baimaclia, Tatareshti* and *Noul Caragaci.*

2) *Moldavia*

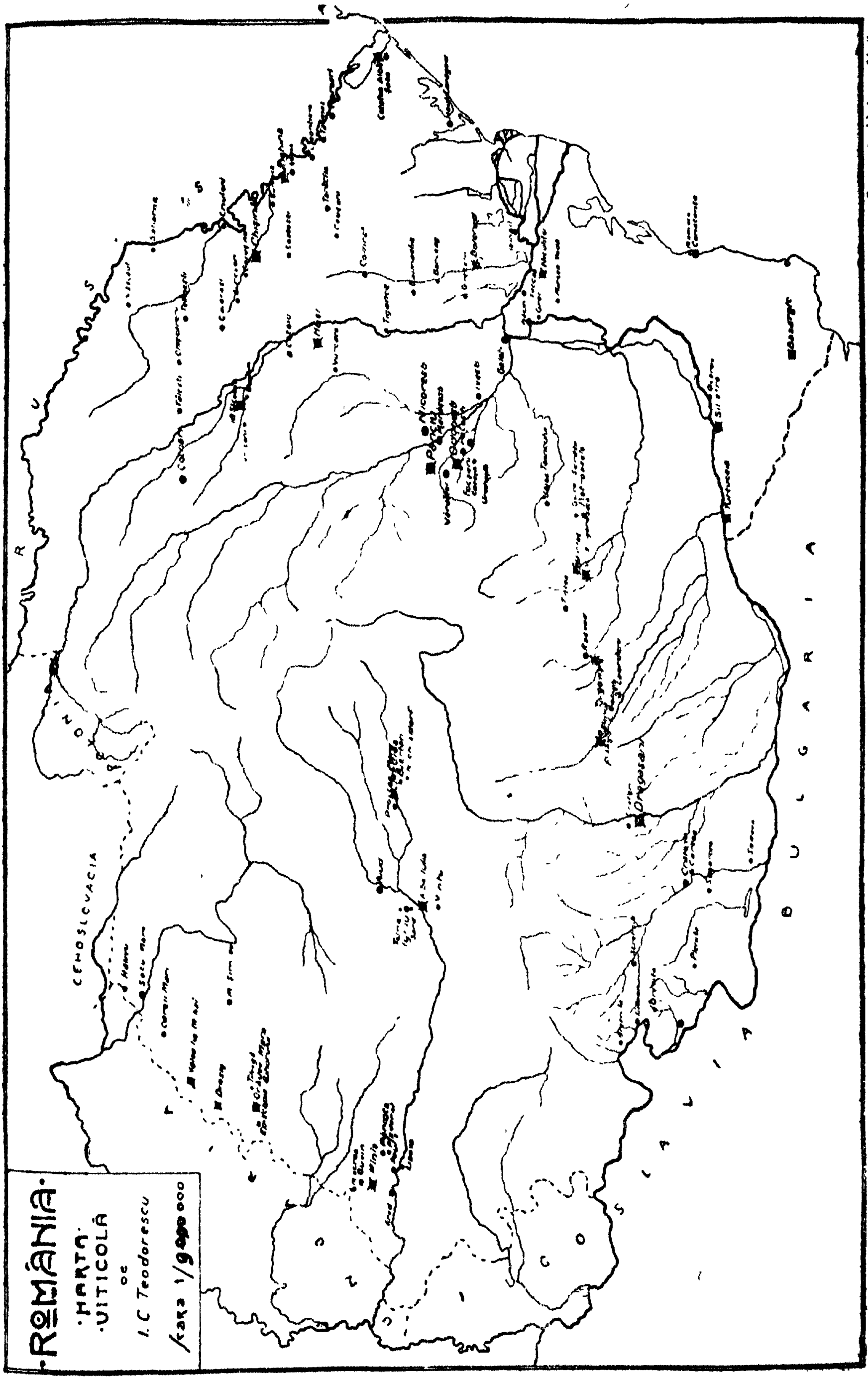
The most noted vineyards in the North of this province are those at *Cotnari*, near Harlau, and those in the neighbourhood of *Iassy* (*Copoul, Vishanul, Doi Peri, Bucium, Uricani*, etc.).

In Central Moldavia are the fine "Codru Tigheciu" vineyards, at Hushi, together with the Vutcani, Cotzoiu, Pleshu, Turbatu, etc. regions.

But the most celebrated vineyards in the country, renowned for their extensive production, good quality and the important trade carried on in the district, are in South Moldavia.

The great vineyard centre of Odobeshti, with branches at Patzeshti, Zarishtea and Varsatura, is placed in the first rank; then comes Panciu and its neighbourhood: Tzifeshti, Clipiceshti, Stracane and Pauneshti, and finally Marasheshti with Padureni, Pufeshti, etc.

The second place is held by the Nicoreshti vineyards near Tecuci, with the Piscul Corbului, Coasta Lupei and Sârbii regions, which are noted for the wines formerly produced there, and have ramifications extending along the Sireth valleys as far as Galatzi, near which are certain of the most highly prized vineyards.



Desen de Valeriu Naibes

FIG. 29. — Vine-growing map of Roumania, showing only the central regions.

3) *Muntenia*

The vineyards extend along the hills below the Carpathians, commencing with Odobeshti and continuing as far as the River Olt, which separates this province from Oltenia.

The most renowned centres in this long strip of vineyards are *Dealul Mare*, with the *Bucov*, Scaeni and Tzintea districts on one side and the Valea Calugareasca, Urlatzi and Ceptura on the other ; these are the best known vineyards in Muntenia.

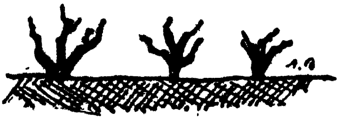


FIG. 30. — Short pruning adopted in the sandy regions of Cetatea Alba (Bessarabia) and Valealui Michai (Transylvania).

Next come the Busau vineyards with the *S*adul Sapat, Pietroasele, Gura Saratzii and Valea Teancului districts ; continuing in this direction the very fine vines of Rămnic-Sarat, Urecheshti, Coteshti, Faraoane and Varteshcoiu are reached.

In the second rank come the vineyard district of Targovishte with the Razvadul and Gura Ocnitzei districts and the Muscel district with the Piteshti hills, in which the most important places are : Goleshtii, Loerdinii, Florida and Titeshti.

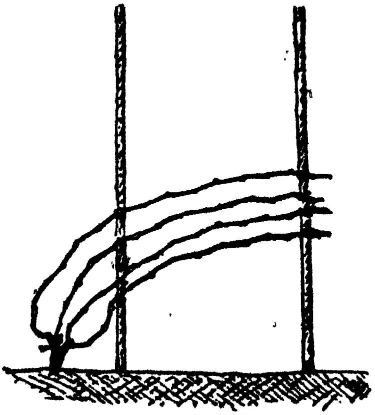


FIG. 31. — Pruning adopted at Sarica (Dobruja)

4) *Oltenia*

The vineyards of this little province are no longer so numerous as formerly, but they have a very special reputation.

The celebrated Dragashani vines are found here, as also those of the *Maciuca, Calnia, Cretzeni, Orbeshti,* etc., districts. There are also the *Golul Drincei* and *Orevitza* vines.

Next comes the area in the neighbourhood of *Craiova,* with what are known as the *Vulcaneshti* vineyards, which extend towards Cârcea and Gherceshti. The vines of the *Segarcea* Crown lands in the *Dealul* district, *Bobului* and *Sadova, Plenitza* etc. are also well known. In the neighbourhood of *Turnu Severin* other fair quality vineyards are to be seen at Bresnitza, Simian, Glogova, Hinova, Strebaia, etc.

5) *Dobruja*

The vineyards are grouped according to centres, of which the best known is that of *Sarica*, Dept. of Toulcea, with branches at *Badila*, *Niculitzel*, *Isaccea*, *Cocosh*, *Măcin* etc.

The vineyards in the neighbourhood of *Constanza*, *Silistria*, *Turtucaia*, *Caliacra* and *Balcic* are also important.

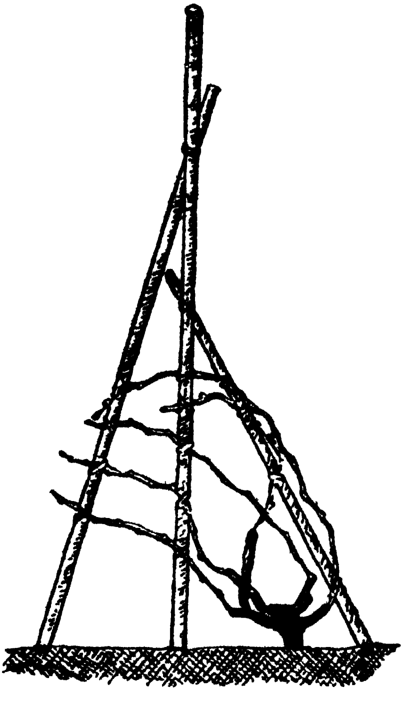
6) *Transylvania*

The reputation of the vineyards of Transylvania is high outside Roumania.

The most important centres in this province are.

a) The *Alba Julia vineyards*, noted for the bouquet of their wines, the following being the most important districts · *Ighiu*, *Tzelna*, *Ighiel*, *Bucerdea*, *Shard*, *Cricau*, *Cimbrut* and *Aiud*.

b) The Tarnavele vineyards, with an equal reputa. tion for the fineness of their wines, are principally in the following localities. *Mediash*, *Prostea*, *Mare*, *Bogaci*, *Basna*, *Bichisdorf*, *Sheica*, *Mica*, *Biertan*, etc.



FIG, 32 — Pruning adopted at Pietroasa (Buzan, Muntenia)

c) *The Arad vineyards.* These vineyards are of enchanting beauty. They extend for a distance of more than 40 km. and the most esteemed wines are produced at *Minis*, *Paulis*, *Mocrea*, *Magherat*, *Pancota*, and then at *Shiria*, *Baratzea*, *Cuvin*, *Ghioroc*, etc. ·

d) The Bihor vineyards (Eriul district) include the *Oradea Mare* vines, with ramifications towards *Episcopia Bihorului* at Alejd; from Teleaga towards the heights of *Bezul*; from *Voideni* to *Ianca*, *Diosig, Secueni,* towards the *Mihai Valley* and *Shimian,* whence they take the direction of *Careii Mari.*

The best wines of the district are obtained at *Marghita, Abramutz* and *Lecimer,* and also at *Magura Salagiului Tashuad.*

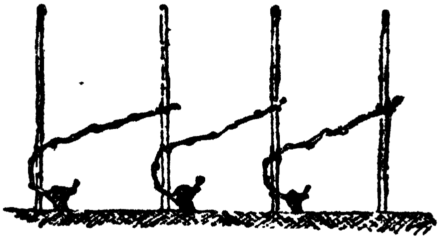


FIG. 33. — Pruning adopted at Dragashani (Oltenia).

e) *The Satul Mare and Halmei vineyards.* The last region of North Transylvania possesses fine vineyards at *Careii Mari, Satul Mare. Tashnad, Sanisläu* and at *Seini, Teutzi* and *Baia Mare* the wines appear to be the best of the district.

f) *The Banat vineyards.* Though almost in open country, the Banat, thanks to good methods of cultivation produces fair quality wines, especially at *Aradul Nou, San Nicolaul Mare, Teremia Mare* and *San Petru Mare.*

METHODS OF CULTIVATION.

In general, three kinds of pruning and cultivation are adopted in Roumania :

a) *Pruning close to the stocks* is adopted in the vineyards at Erful, Bihor, Satul Mare and Valea lui Mihai in Transylvania, at Cetatea Alba in Bessarabia and as yet only to a small extent in the Dept. of Constanza (Dobruja) and the Depts. of Dolj and Mahedintz in Oltenia (Fig. 30).

Generally from 6000 to 8000 plants are set per hectare and the young shoots are tied to a single pole.

b) *Mixed pruning,* similar to Dr. Guyot's, but modified by leaving from 2

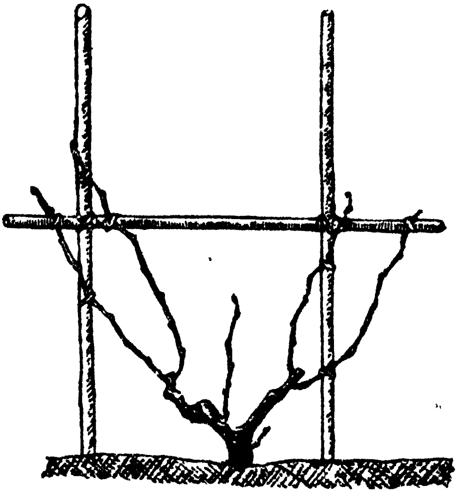


FIG. 34. — Pruning applied to the direct producer hybrids in Bessarabia.

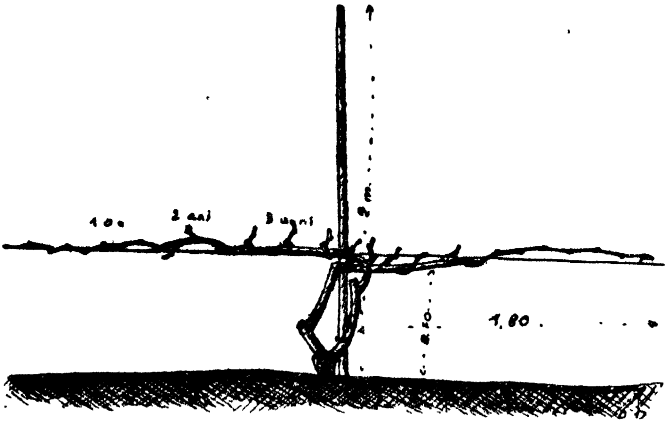


FIG. 35. — Vine trained on wires in Roumania.

to 4 and even 12 shoots on each plant. The pruning and tying-up methods are different, but in all of them the vine is trained on espaliers or props. Generally from 3,500 to 6,000 plants are set per hectare (Figs. 31-40).

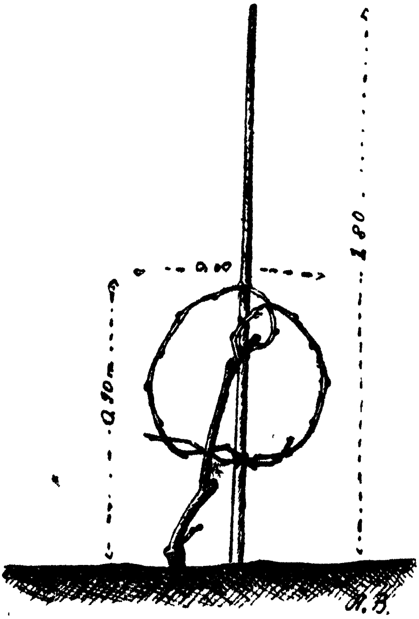


FIG. 36. — Ring pruning in Transylvania.

c) " Umbrella " or " Moldavian " pruning is a quite special local method employed in Moldavia and Bessarabia on rich soil exposed to late cold and white frosts. It consists in leaving 4 or 5 of the larger and older canes on which 8 to 12 or as many as 14 long fruit bearing spurs are also left, with from 8 to 12 shoots. Only the stronger varieties can endure this form of pruning. From 8 to 16 hundred vines are planted per hectare, each supported by 10-20 light poles (Figs. 41-45).

Some typical varieties of Roumanian vines.

1) The renowned red wines of *Orevitra* and *Golul Drincei* (Dept. of Mehidintz) which were formerly much sought after abroad, were prepared from the following varieties :

⅓ Negru Vertos
⅓ Negru moale
⅓ Berbecel

2) The fine *Dragashani* wines are made from :

⅓ Crâmposia
⅓ Braghinâ
¼ Gordan Tämâfoasa Alba (muscat).

3) The *Odobeshti* wines :

⅔ Galbenä
⅓ Plävae.

4) The *Cotnari* wines :

⅓ Grasa
⅓ Feteasca
⅓ Fräncusa Busuicaca (muscat).

5) The *Alba Julia* wines :

½ Feteasca
¼ Grasa
¼ Furmint

6) The *Minish* wines :

red : ⅔ Cadarca neagra
⅓ Pinot Cabarnet;
white : Eustoasa
Alb marunt
Bakator.

7) The *Eriul* (Bihor) wines :

Ardeleanca
Coada Oii
Bakator.

8) The *Bessarabian* wines :

white : Pläavaia
Galbenä
red : Bara neagrä
Negru de Cäusani

Table showing the most important Roumanian varieties, their ripening period and the province in which they are most cultivated (1).

A) *Varieties of Table Grapes.*

1) Alb mare	II (Moldavia)	8) Poama Mare	II (Moldavia)
2) Băsicată	II (Muntenia)	9) Bazachia rosie	II (Muntenia)
3) *Ciaius*	III (Dobruja)	10) Slavitza	I (Oltenia)
4) Coarna Albă	II (Oltenia and Muntenia)	11) Tamaicasa alba	II (throughout the country)
5) Coarna Neagra	III (Muntenia)	12) Tamaicasa rosie	II (Muntenia)
6) Ochii boului	II (Bessarabia)	13) Tâta caprii	II-III (Muntenia & Dobruja)
7) Coama boereasca	II (Moldavia)	14) Tâta vacii	III (Oltenia)

B) *Varieties of White Wine Grapes.*

1) Albissori	II (Transylvania)	17) *Gordanul*	II (Oltenia)
2) Armas	I-II (Moldavia)	18) Gordinul	II (Muntenia)
3) *Ardeleana*	II (Transylvania)	19) Iordan	II-III (Moldavia) Transylv.)
4) Batută albă	II (Bessarabia)		
5) Berbecelul	I-II (Oltenia)	20) Mischet	II (Dobruja)
6) Brumaria	II (Bessarabia)	21) *Mustoasa*	II-III (Moldavia & Transylv)
7) Cabasma	II (Bessarabia)		
8) Cioinica	II (Moldavia & Bessarabia)	22) Omorău	II (Moldavia)
		23) Ovis	II (Muntenia)
9) Coada-oii	II (Transylvania)	24) *Plăvaia*	II-III (Moldavia & Bessarabia)
10) *Crâmposia*	II-III (Oltenia)		
11) Creata	II (Transylvania)	25) *Samoveanca*	II (Dobruja)
12) Crucoilita	II (Moldavia)	26) Seina Albă	II (Muntenia)
13) *Feteasca*	II (Moldavia & Transylv.)	27) *Silvan verde*	II-III (Transylvania)
		28) Struguri Craesti	II (Transylvania)
14) Frâncusa	II-III (Moldavia & Transylv.)	29) *Tămâioasa*	II (everywhere)
		30) Verdea	II (Moldavia)
15) Galbena	II (Moldavia & Transylv)	31) Zghihara	II-III (Bessarabia)
16) Grasa	I-II (Moldavia & Transylv.)		

C) *Varieties of Red Wine Grapes.*

1) *Braghina*	II (Oltenia)
2) Romania	II (Oltenia)
3) Bosioara	II (Oltenia)
4) Vulpea	II-III (everywhere)

D) *Varieties of Black Wine Grapes*

1) *Babeasca neagra*	II-III (Transylvania)	5) *Negru Vertos*	II-III (Oltenia)
2) *Cadarca*	II-III (Moldavia)	6) Păsăreasca	II (Moldavia)
3) Negru bulgar	II (Bessarabia)	7) Poama Calului	II (Oltenia)
4) *Negru de Căusani*	II (Moldavia & Bessarabia)	8) *Negru moale*	I-II (Oltenia & Moldavia)

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(1) The most important varieties are printed in *italics.*

VIII. — Principal Foreign Varieties cultivated in Roumania.

1) Alicante Bouchet	(Muntenia and Oltenia)
2) Aligoté	(Bessarabia)
3) Aramon	(Oltenia)
4) Cabernet Sauvignon	(all over the country)
5) Chardonnay	(Bessarabia)
6) Chasselas	(all over the country)
7) Clairette	(Oltenia and Muntenia)
8) Consaut	(Muntenia and Bessarabia)
9) Colombard	(Muntenia)
10) Durif	(Bessarabia)
11) Furmint	(Transylvania)
12) Gamay	(Bessarabia)
13) Grand Noir de la Calmette	(Muntenia)
14) Honigler	(Transylvania and Moldavia)
15) Malbec	(Bessarabia)
16) Merlot	(Bessarabia)
17) Meslier	(Bessarabia)
18) Mondeuse	(Bessarabia)
19) Muscadelle	(Bessarabia and Muntenia)
20) Muscat Frontignan	(Oltenia and Moldavia)
21) Muscat Ottonel	(Moldavia and Transylvania)
22) Petit Buchet	(Oltenia and Muntenia)
23) Pinot	(all over the country)
24) Portugais bleu	(Transylvania and Bessarabia)
25) Rhein Riesling	(all over the country)
26) Sauvignon	(Muntenia and Bessarabia)
27) Sélection Carrière	(Moldavia)
28) Semillon	(Moldavia and Bessarabia)
29) Traminex	(Transylvania and Bessarabia)
30) Welch Riesling	(Transylvania)

Direct Producer Hybrids introduced into Roumania.

1) Alicante × Rupestris Terras No. 20 (Muntenia, Oltenia and Moldavia)
2) Delaware red (Transylvania)
3) Chasselas pink × Rupestris 4401 Couderc (Bessarabia)

4) Seibel Nos. 1, 14, 156, 848, etc. (Bessarabia, Moldavia)
5) Noah (Transylvania)
6) Gaillars Girars No. 157 (Moldavia)

Grafting Stock used in Roumanian Vine-growing.

65 % Riparia gloire de Montpellier (Portalis)
20 % Riparia × Rupestris 3306, 3309 and 101-14
10 % Berlandieri × Riparia 420-A and Teleky
5 % Aramon × Rup Ganz No. 1, Mourvèdre × Rup 1202, Rupestris du Lot, etc. . . .

INSTRUCTION IN VINE-GROWING.

1. The National School of Vine-growing at Kishinau, organised after the model of the middle schools at Montpellier, Geisenheim, Conegliano and Kosterneuberg, is provided with every modern appliance, such as laboratories, a museum, fields for collections of specimen vines as well as an experimental station of vine-growing and wine-making, with sections for vine-growing, chemistry of wine-making, microbiology, agreogeology and a subsection for meteorology. The courses last four years; pupils holding the diploma for the four secondary classes of a *lycée* are admitted.

Connected with this School there is also a well-equipped bio-entomological station.

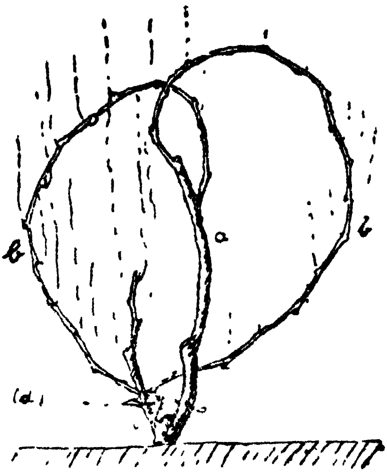

FIG. 37 — Pruning in Transylvania.

2. There are *Practical Schools of Vine-growing* at: *Scharna* (Bessarabia), *Hushi* and *Odobeshti* (Moldavia). *Valea Calugareasca* (Muntenia), *Minish* and *Diosig* (Transylvania) Their object is the training of good practical workers capable of managing vineyards, cellars, or vine nurseries, etc.

The practical school courses last 4 years and pupils holding the elementary school certificate are admitted. All the vine-growing schools have accomodation for boarders ; 75 % of the boarders hold Government scholarships and 25 % are paying scholars

3. In addition to these special schools, all the higher schools of agriculture have a lectureship in vine-growing and oenology and instruction in vinegrowing and wine-making is given in all the intermediate schools of agriculture

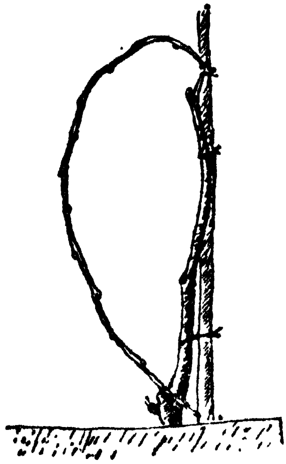

FIG. 38. — Special form of pruning adopted for the Cadarca variety at Minish (Transylvania).

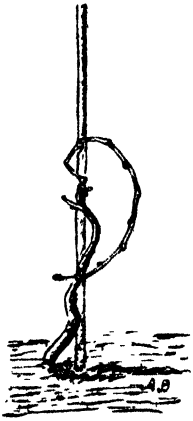

FIG. 39. — Pruning in Transylvania.

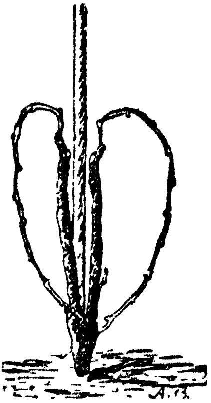

FIG. 40. — Pruning in Transylvania.

State Vine-growing Institutions

A) *Vine nurseries* :
  a) Bessarabia
    1) *Bucovătz*
    2) *Ismail*
    3) *Botnareshti*
    4) Noul Caragaci
    5) Comrat
    6) Dealul Codrului.
  b) *Moldavia* :
    1) *Cotnari*
    2) *Vishan*

- 3) Nicoreshti
- 4) *Petreshti*
- 5) Bärlad.

c) *Muntenia* :
- 1) *Istritza*
- 2) *Goleshtii Batii*
- 3) Draganeshti

d) *Oltenia* :
- 1) *Strehaia*
- 2) *Dragashani*
- 3) Magheresti.

e) *Dobruja*
- 1) Murfatlar.

f) Transylvania :
- 1) *Ceala*
- 2) *Baratzca*
- 3) Recash
- 4) Tashnad
- 5) *Ighiu*

B) *Vine-growing Stations* :
- 1) Kishinau (experimental station)
- 2) Baltzi
- 3) Cetatea Alba.

C) *Experimental ad Demonstration Vineyards* :
- 1) Kishinau
- 2) Costiugeni
- 3) Pietroasa.

D) *Large Government Cellars* :
- 1) *Minish* (20,000 hl.)
- 2) *Diosig* (15,000 hl.)
- 3) Cluj
- 4) Dicio San Martin.

E) *Laboratories for Wine Analysis* (1) :

4 at Bucharest
2 » Iassi
1 » Cluj
1 » Kishinau

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(1) In connection with the application of the law against fraud in vine-growing and the wine trade.

1 at Arad
1 » Craiova
1 » Statul Mare
1 » Constantza
1 » Galatz

This list of laboratories does not include the Agronomical Station at Bucharest, which possesses a special section for wine chemistry.

PRIVATE ORGANISATIONS.

a) There are more than 40 vine-growing nurseries in the country, the most important being :

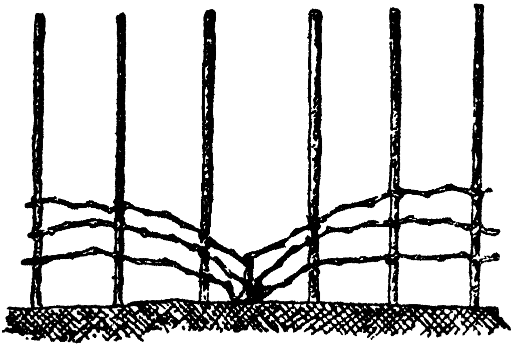

FIG. 41. — Long pruning adopted at Cotnari (Moldavia).

1) Ambrosi's nurseries at Aiud and Mediash (Transyl.) ;
2) Gaspari's nurseries at Mediash (Transyl.) ;
3) Prince Stirbey's nurseries at Buftea (Muntenia) ;
4) Prince Brancovean's nurseries at Brancoveni (Oltenia) ;
5) Meyer's nurseries at Florica (Muntenia) ;
6) Bernard and Co's nurseries at Tecuci (Moldavia) ;
7) Czell Bros.' nurseries at Collentina (Mun.) ;
8) I. Pasculescu-Buftea's nurseries at Cràvedia (Mintenia) ;
9) Cèl. Solacolu's nurseries at Bucarest (Montenia) ;
10) Scgrager Bros. ' nurseries at Kitila (Muntenia) ;

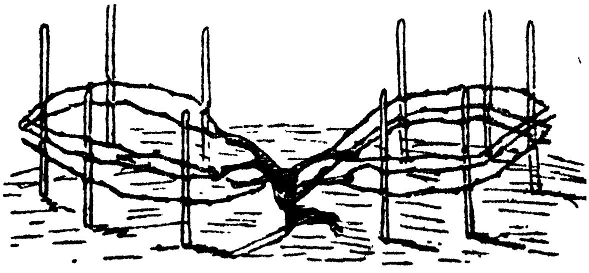

FIG. 42. — "Moldavia" pruning at Odobesti (Moldavia).

11) Marcoci's nurseries at Tassy (Moldavia) ;
12) Silberman's nurseries at Kishindu (Bess.).

b) *Vine-growing Societies.*

There are in all 31 Departmental vine-growing Societies (1), with 27 000 grower members, representing 72 428 hectares of vines. All these syndicates are united in a " Vine-growing Societies Union "

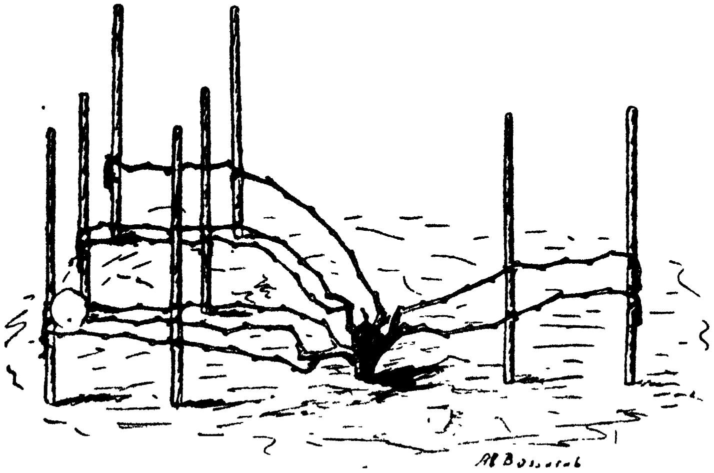

FIG. 43. — Special system adopted by the vine growers at Husi (Moldavia)

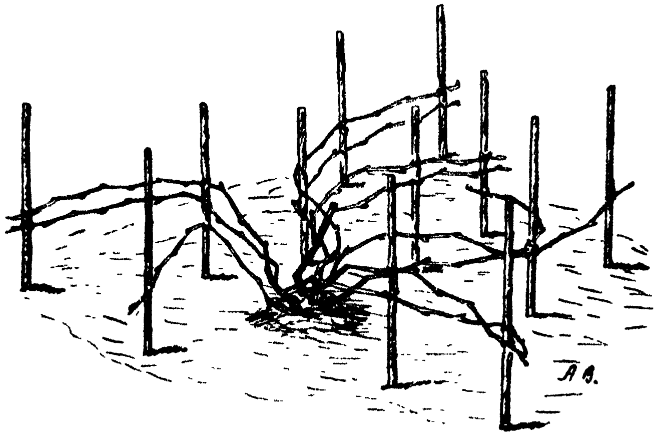

FIG. 44. — Classic " Moldavia " pruning

with its headquarters at Bucarest. Unfortunately the Vine-growers' Union is only concerned with the joint purchase of materials and the protection of general interests, and not with the realisation of production. A large vine-growers' bank and numerous other smaller banks provide the necessary capital for vine-growing.

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(1) In Muntenia there are 12 vine-growing Societies, in Moldavia 7, in Oltenia 4, in Bessarabia 3, in Transylvania 2 and in Dobruja 3.

There are numerous wine depôts in the country. The trade is carried on by foreign merchants, who assist materially in placing the wines on the home market, and are in a position to take up exportation.

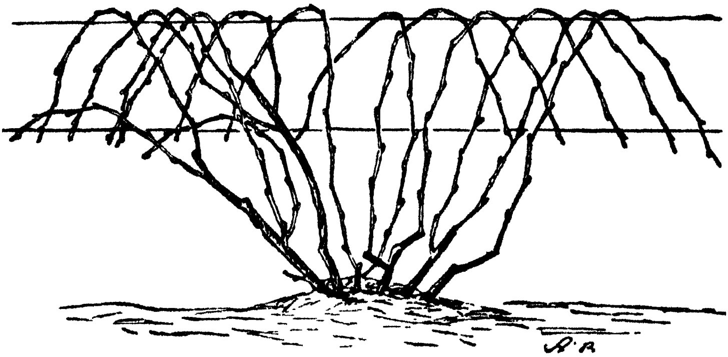

FIG 45. — Very long pruning adopted in the most productive vineyards of Moldavia.
Vines trained on wires

There are numerous wine-producing firms in the country which sell their wines direct, as well as firms which produce sparkling wines of the Champagne type.

In Rumania as a rule new wine, that is wine in the first year of production, is used. Only certain large proprietors and connoisseurs allow their wines to mature.

The collection of wines at the National School of Viticulture at Kishinău is celebrated; it includes over 20 000 bottles, classed in series and varieties, from 1894 up to the present time.

I. C. TEODORESCU,
Inspector of Viticultural Instruction and Lecturer on Viticulture, at the Higher School of Agriculture, Herăstrau (Bucharest).

PLATE XIV.

FIG. 46.—"Rara Meagra" stock trained in the "Moldavia" form (Photograph from the Experimental Vine-growing Station at Chisinau)

PLATE XV

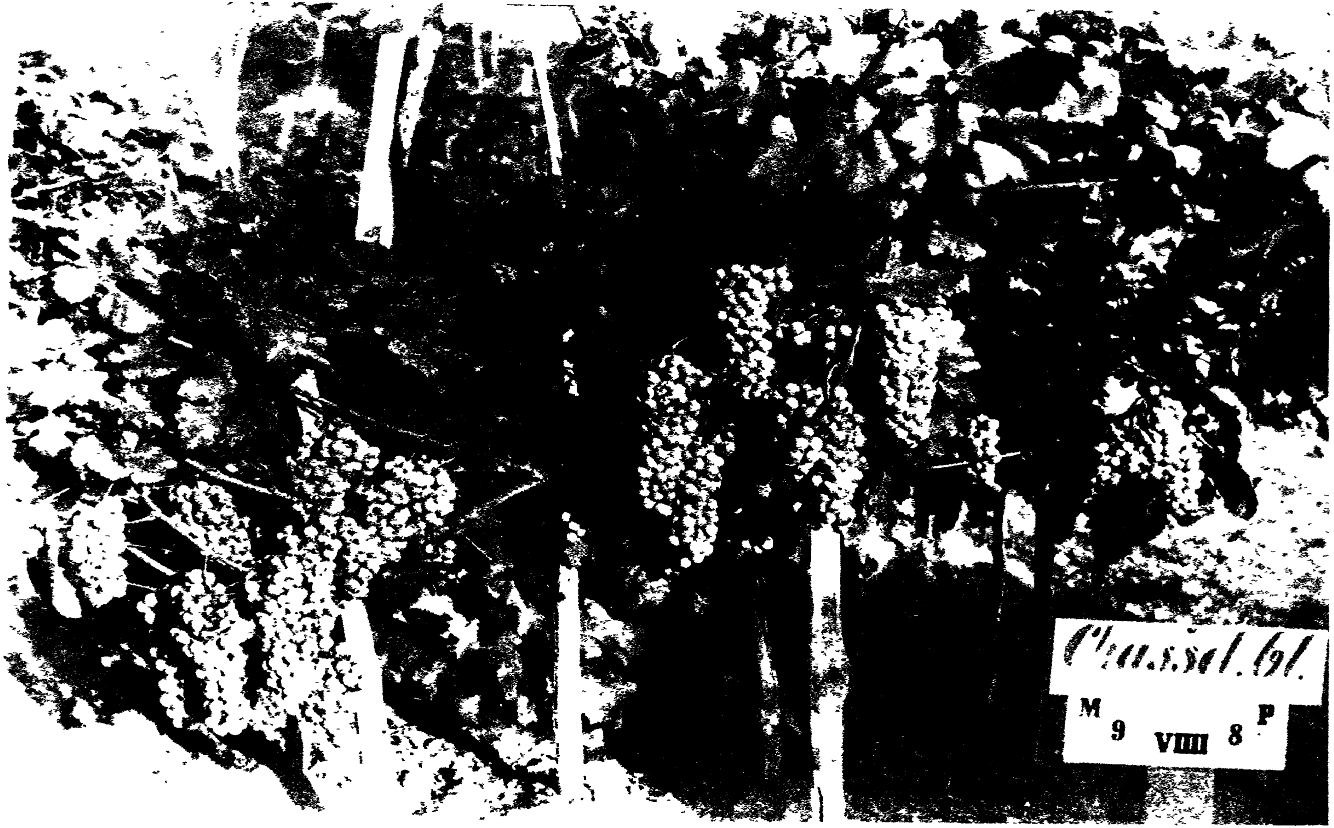

FIG. 47. — "Chasselas blanc" stock trained in the "Moldavia" form (Photograph from the Experimental Vine growing Station at Chisinau)

PLATE XVI.

FIG. 42. Method of earthing stocks trained in the "Moldavia" form in Roumania. The stocks covered

PLATE XIX.

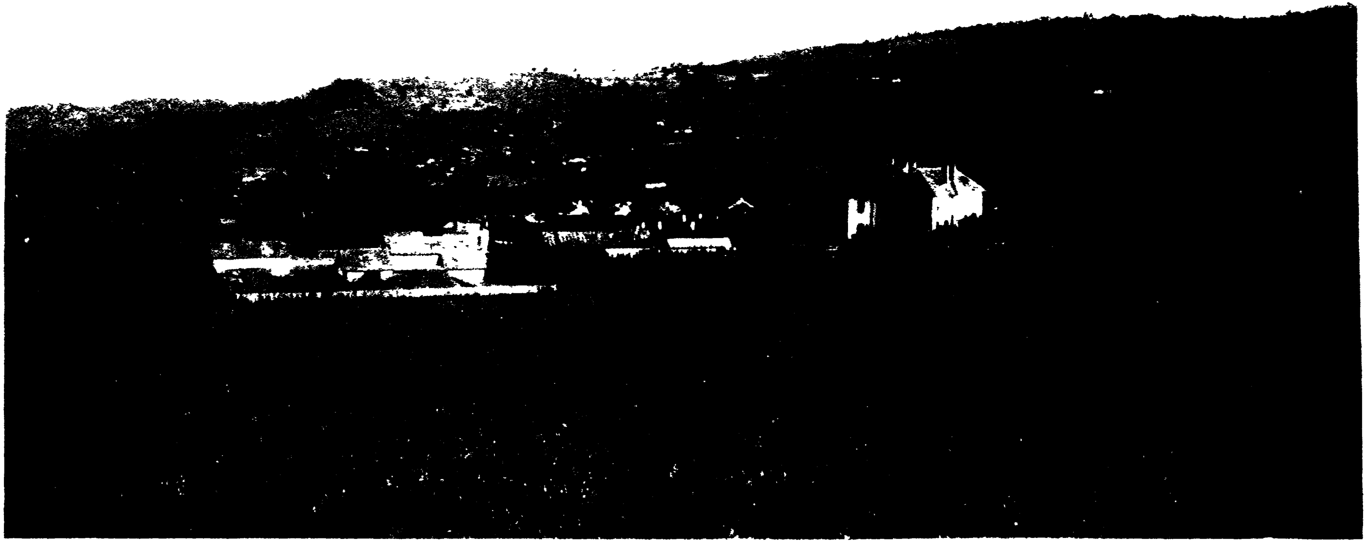

Fig. 51.—General View of the Practical Vine-growing School at Husi (Moldavia).

BIBLIOGRAPHY.

W. Hamm: Das Weinbuch. Leipzig, 1886.

G. N. Nicoleanu: Introduction à l'ampélographie roumaine, 1900.

Dr. Ch. D. Drutzu: Etude sur la viticulture et les vins de la Roumanie, 1900.

V. C. Munteanu and Corneliu Roman: Les vins de la Roumanie, 1900.

I. C. Teodorescu: Organisation de la production et de la vente en viticulture, 1924.

L. Portes and F. Bouyssen: La vigne en Russie, Paris, 1892

P. Milleffert. Les vignobles de France et de l'étranger

NUTRITIVE VALUE OF PHOSPHORUS IN CATTLE FEEDS.

The mineral elements most necessary to the animal organism are phosphoric acid, lime, chlorine, potassium, soda, magnesia and iron. The proportion of these elements varies according to the nature of foods, and in the case of plants, according to the state of the soil, its composition, the nature of the fertilisers used and the quantity of water it contains.

Recent works have drawn attention especially to the importance of lime in the functioning of the different elements in the animal organism. The important part it plays in the origin of certain processes of rachitis, apart from poorness in vitamines, is well known. Further, recourse to carbonate of lime is advised when the quantity of phosphorus is sufficient. The carbonate of lime is partially dissolved through the aleatory carbonates of the intestinal fluids which transform it into bicarbonate. In this form it enters the blood and the bone cells transform it into bone phosphate of lime through the aid of alkaline phosphates.

If there is also a deficiency in phosphorus, phosphate of lime must be used ; but it is generally admitted, at least in Europe, that this is rather exceptional.

During our stay at the veterinary laboratory at Pretoria in May, 1923, we became fully acquainted with its research work tending to prove that deficiency in phosphorus is an important factor in the etiology of a disease known in South Africa under the name of *lamziekte.*

The discoveries in this connection made by Doctor THEILER, Director of the Research Laboratory, and his collaborators, Dr. GREEN and DR. DU TOIT, led these scientists to extend the field of their researches to the part played by phosphorus in food, thus envisaging more closely the economic point of view. This side of the question is not without interest for Belgium, and similarly we should likewise realise the possibility of the existence of *lamziekte* in our own colony. This has induced us to publish the notes taken on the spot, which can be completed by a report from the authors quoted. We shall not however deviate from the principal and more important aspects of the problem, omitting purely technical details.

Lamziekte is a disease which has been known in South Africa for about fifty years and has spread considerably in Bechuanaland. It is not a contagious disease, as was at first believed, though the unburied bodies of animals which have succumbed to the disease may be the cause of its dissemination in localities hitherto immune. The reason of this is as follows: investigations have proved that, to contract the disease, animals must be attacked by the form of pica known as *osteophagy* and also consume the carcasses of animals containing a ptomaine produced by a bacillus allied to the *Bacillus botulinus*. This bacillus is a saprophyte of certain soils.

The disease has been reproduced experimentally in the horse, sheep, goat, ostrich, duck and guinea pig. But under natural conditions these are but rarely attacked owing to the fact that osteophagy rarely develops among them.

The spread of the disease is dependent on the season. Heat and drought at the beginning of summer are favourable to the multiplication of the organism, when the carcases are in a state of decomposition.

The extension of the disease depends on four chief causes: flies, dust, birds and transport by animals over long distances. The flies only serve as an instrument for mechanically conveying the infection from one carcass to another. Birds and dogs, transporting the remains of bodies, propagate the disease at a distance.

The results of experiments made show that the bacterium causes the disease only when generated in organic matter.

Pica. — The depraved appetite of livestock is not confined to South Africa, but over extensive tracts of this country a large percentage of the animals show a preference for bones, whence the name osteophagy. Further, this osteophagy exists in varying degrees. Thus, the animals may eat the bones if they come upon them by chance, or they seek them, or again certain individual animals select bones in a slight state of corruption, whereas others attack those in an advanced state of putrefaction. The cause of osteophagy is certainly a lack of phosphorus in the food, as we shall see later. It is more marked when the pasture on which the animal lives contains the smallest quantity of phosphates, and less accentuated after the rains at the beginning of summer when the new grass is richer in phosphates.

Similarly, osteophagy disappears after the administration of phosphorus in any form whatever.

It does not follow that *lamziekte* must necessarily prevail from the fact that osteophagy is very common in a district. The bacterium indeed must be present and protein substances lend themselves to its development and the production of toxins. Also the bacterium and protein substances may be present and *lamziekte* remain unknown if the soil is sufficiently rich in phosphorus and if the animals are not thus predisposed to osteophagy. Nevertheless, the latter always renders possible the appearance of the disease.

Symptoms. — Generally speaking, it appears without warning. At most, signs of general weakness become evident for a day or two. A very acute, an acute, and a moderate form may be distinguished.

Highly acute form. — Death ensues very quickly, or the animals are found dead without having shown any marked symptoms. It was formerly mistaken for anthrax. This is the rarest form.

Acute form. — The most common. The animal is dull and neglects its food. Then ensue muscular weakness, the stiffening of the hind quarters and a tendency to fall ; decubitosis becomes permanent and paralysis sets in. Temperature normal. Constipation. Sometimes paralysis of the pharynx and tongue and hypersalivation. The sickness lasts for some days and death usually ensues.

Moderate form. — Less frequent. The stiffening of the hind quarters and progressive muscular weakness are noticed. The appetite is more or less normal. Decubitosis is more frequent, and after a fortnight the symptoms become more pronounced and death may ensue. Cures have, however, been effected.

Lesions. — Nothing specific. Various congestions and spots.

Prophylaxis — Treatment. — In order that adequate measures, may be adopted the etiology should be borne in mind. It may be summarised under six heads

1. The toxin which poisons the animal ;
2. The saprophytic bacillus producing the toxin ;
3. The dead body in which the toxin is produced ;
4. Pica, or perverted appetite, which urges the animal to eat decomposed matter ;
5. The vegetation producing pica, the soil on which it grows and the climate ;
6. Predisposition of the animals to contract this pica and their receptive capacity for toxin.

Theoretically, it would be easy to dispense with No. 3 by removing the carcasses from the fields, which would be followed by the disappearance of *lamziekte*. But this is not a practical solution of the problem, owing to the difficulty of finding the bodies, at least those of small animals. The simplest procedure is to supply the livestock with bone meal. It should be noted that the toxin being destroyed by heat, the bones of carcasses may be used for this purpose after boiling. If the animals are numerous, those presenting symptons of osteophagy should be sought out and fed from troughs containing bones which have been subjected to the action of heat, and they should be removed from the herd and given bone meal.

An attempt may now be made to draw conclusions from the tests made, in order to determine the action of phosphorus on various functions of the organism.

A) *Influence of phosphorus on weight, general health and growth.* — As we have already stated, osteophagy is a proof of the lack of phosphorus in food. If this element be added, the gain in weight is extraordinary, as shown by tests made on two lots of animals on pasture of which one had received a supplement of bone meal. The phenomenon is more marked with younger animals, seeing that growth as well as fattening is influenced by the phosphorus factor.

B) *Is the quantity of phosphorus required to prevent osteophagy equal to that which is most favourable to growth?* — Though osteophagy is an excellent index of deficiency in phosphorus, it does not show the exact quantity of phosphorus required in feeds. A certain number of animals, especially of young animals, on the other hand, show no traces of osteophagy, while their need of phosphorus may easily be proved. Further, osteophagy often appears when the extent of the deficieney in phosphorus is clearly below the highest needs, from a nutritive point of view. Thus, all other conditions being similar, the increase in weight was 166 lb. for a calf under treatment; 295 lb. for one receiving just enough phosphorus to prevent osteophagy, or in all 15 lb. of bone meal, and 352 lb. for one receiving an excess of bone meal, or a total of 75 lb. It is clear that the quantity of bone meal required to prevent osteophagy has a great influence on growth, but is not the optimum quantity. Tests which are being made will determine the latter, as well as the "most economic" quantity, in connection with growth, fattening, gestation and milk secretion.

C) *Influence on milk yield.* — The absence of phosphorus is a factor which limits milk production. The data will be published later.

D) *Weight and strength of the calf at birth.* — Calves born of cows receiving phosphorus are heavier and stronger.

E) *Precocity.* — Animals lacking phosphorus are less advanced.

F) *Quality of meat.* – The muscular system is more developed under the influence of phosphorus, the meat more tender, and has a higher percentage of butcher's meat. This is an important point in exportation.

G) *Influence of phosphorus on consumption of food.* — Livestock receiving phosphorus consume more hay and utilise it better, i. e., the unit of food consumed produces a higher increase in weight.

Lack of phosphorus in plants. — A complete analysis of grass at different times of the year enables the following conclusions to be drawn (tests carried out on the Armoedsvlakte farm at Vryburg) :

Young grass at the beginning of spring (October-November) is very nutritious and rich in phosphorus, but after the fall of the seed (April-May), its nutritive value is reduced by at least half and is equivalent to that of poor European hay. The chief factor is the lack of phosphorus, only 0.08 % of P_2O_5 being present, or one-fifth of the quantity in European hays When the grass matures, the formation of carbohydrates is more rapid than the absorption of phosphorus from the soil, so that the proportion P_2O_5 rapidly falls. This is the cause of osteophagy, and the administration of compounds containing phosphorus prevents the reappearance of the disease with its deleterious effects on the development of the animals.

Similarly, the consumption of young grass, grown after burning, attenuates the symptoms of osteophagy.

In this connection, the two following deductions may be made :

a) the development of osteophagy in animals varies in inverse ratio to the proportion of phosphorus in plants ;

b) the lack of phosphorus is evident during the whole year, but is less pronounced at the beginning of spring, and sometimes is no longer found at this period, when a large quantity of young grass is fed.

Effects of administering different forms of phosphorus. — A rapid diminution of cases of osteophagy is brought about by the use of four compounds containing phosphorus : wheat bran furnishing it in organic form associated with a relatively small quantity of other mineral matter; bone meal supplying phosphorus in the form of calcium phosphate; sodium phosphate in which the phosphorus is in combination with another base; phosphoric acid, eliminating all bases and making it evident that there is a lack of phosphorus and of nothing else. Phosphoric acid, nevertheless, is not convenient in practice, seeing that it reacts as a fixed acid which disturbs the base-acid equilibrium of the organism.

The most advantageous form is bone meal, which is liked by animals and causes no digestive troubles. Phosphate of calcium precipitate has the same action as bone meal, but is less economic and less appreciated by animals. Wheat bran should be used for cows in milk.

It is interesting to add that a group of cattle receiving *chalk* retained its perverted appetite for bones similarly and to a greater degree than the group under observation, whereas the group fed on bone meal quickly gave up osteophagy. This seems to show that lime should not be added to bone powder. There is on the other hand no lack of lime for plants on the Armoedsvlakte farm, and the addition of lime probably diminishes the absorption of phosphorus during digestion. In addition, other salts have been used: Glauber's salts, Epsom salts, iron sulphate, sulphur, etc... but so long as phosphorus is lacking, osteophagy continues and there is no appreciable effect.

With regard to the effects of phosphatic fertilisers, they are the same; but again, this process is less economical than the administration of phosphorus to animals by means of a richer substance, at least in arid regions and far from industrial centres and ports.

Work which is now being carried on will afford information as to the possibility of explaining the existence of other diseases by soil analysis. We would point to the research work being done in the district of Ermelo, where a disease called "Styfsiekte" is prevalent, the cause of which is certainly a lack of phosphorus, perhaps also of calcium, the etiologic links of which, however, are still unknown.

We have pleasure also in mentioning recent research work of the highest interest, on poisonous plants, on which we heard an interesting lecture, accompanied by lantern slides and microscopical demonstrations, given by Dr. THEILER himself before the Biological Society at Pretoria.

The same kind of poisoning is probably met with in the Belgian Congo, judging from what we heard and saw at the breeding station at Katentania.

As to *lamziekte*, we have not heard of its existence in the Colony. The local soils however, are generally poor in phosphorus, and until the soil has been sufficiently fertilised, there is no doubt that farmers raising milch breeds, would do well to add bone meal to the feed. The selling price of milk — 4 francs a litre — would justify this slight expense. The same addition might be made by pedigree breeders in order to advance precocity. Attention is also drawn to the advantage of using wheat bran.

In concluding this article we desire to call attention to the richness of the documentary matter on tropical diseases which may be consulted at the laboratory at Pretoria.

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Doctor of Veterinary Medicine,
Professor of the Institute of Agriculture,
Gembloux (Belgium).

MAMMARY MICROFLORA IN RELATION TO CHEESEMAKING.

For a long time past the writer has drawn attention to mammary microflora and has suggested that it has a certain value under normal conditions. Previous writers, including WARD, DINVIDDIE, BOLLEY and HALL, had overlooked the importance of this factor, but gradually it has become a matter for investigation by a number of scientists, by whom the writer's results have been confirmed and amplified.

Special mention should be made of the works published in America by the Agricultural Experiment Stations in the United States and Canada, and in Switzerland by the Federal Bacteriological Laboratory at Liebefeld, near Berne, where in 1901 I made my first investigations on mammary microflora and where my deductions regarding its importance were then received with incredulity by the late Director, Dr. FREUDENREICH, whose views were for some time shared by his colleagues, BURR, BARTHEL, HARRISON, ORLA, JENSEN and KITT.

In response to the invitation from the Direction of the *International Review of the Science and Practice of Agriculture*, the present state of our knowledge of mammary microflora is now given with special reference to hygiene and the dairy industry.

WHAT IS MAMMARY MICROFLORA ?

The term " mammary microflora " should be applied to organisms which are constantly found in cows' udders, though the animals be healthy.

There are two classes of lactic microflora, primary and secondary. The primary is that which issues with the milk from the udder, the secondary that which enters the milk from outside sources during, or after milking. This distinction is important in practice because, while the secondary microflora may be kept away by antiseptic milking, the primary microflora is found in the milk even after antiseptic milking, so that it cannot be eliminated without modifying the physical and chemical properties of the milk itself.

But primary microflora is in turn subdivided into two classes: one of stable and constant character, the other of casual and inconstant character, varying as the microflora which contaminates the outside surface of the udder varies, that is, according to the animals' sleeping quarters (whether they lie on the grass in the meadows or on litter in the stalls, whether the litter consists of straw, leaves, twigs, turf, etc.) and also according to the seasons, fodder, state of cleanliness, etc. (it is, for instance, less prevalent in goats than in cows on account of the different conditions in which they live).

The stable and constant primary microflora, which is indeed settled in the interior of the udder in the centre of the secretory alveolar parenchyma, is rightly called *mammary microflora,* whereas the casual and variable microflora in the lower excretory passages should rather be called *microflora of the milk ducts or teats.* This subdivision is also important in practice; for the microflora of the teats is almost completely expelled with the first milk drawn, hence it is estimated that the greater part of it can be got rid of with the loss of the first twelve jets, equal to about ½ litre of milk; on the other hand the mammary microflora properly so called continues throughout the milking, and is sometimes even more abundant at the end than at the beginning, so that in order to examine it the first portions of milk must be drawn off (the use of the catheter however is inadvisable because it may draw organisms from the milk ducts into the mammary cistern). In short, the mammary microflora is the only flora which persists in the milk in spite of all precautions.

It is to this mammary microflora that my investigations have been directed. Whereas for some time it was considered occasional and capable of being evacuated like the microflora of the teats, it is to-day recognised as regularly and permanently present in the udders of all cows, even of those in normal condition, and hence it has become an integral part of the milk constituents. It is indeed impossible to draw from the udder an appreciable quantity of milk (20-100 cc.) which would be perfectly sterile; so that the opinion that the milk originally supplied by the udder is amicrobic, is untenable.

Whereas this microflora was formerly considered to be quite ordinary and placed on the same footing as the microbes in the air

PLATE XX.

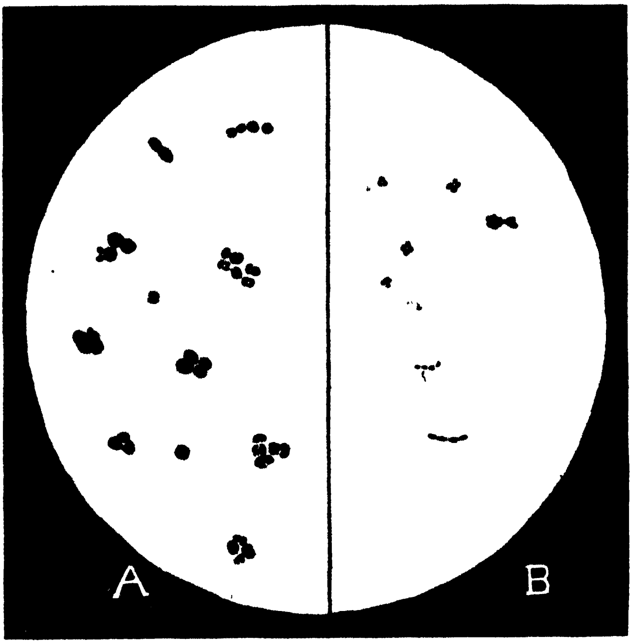

FIG 52 — Proteolytic acid mammary micrococci (500 diam.).
A — Dissolving gelatine (*M. casei acidoproteolyticus* I).
B — Not dissolving gelatine (*M. casei acidoproteolyticus* II)

PLATE XXI.

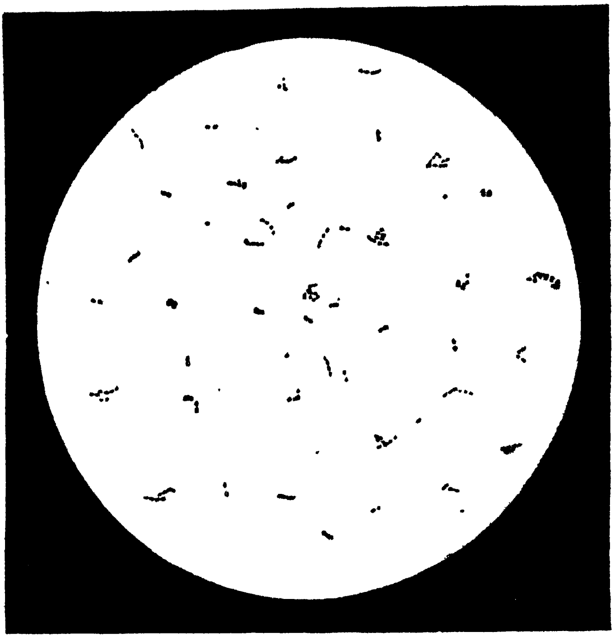

FIG. 53.—Proteolytic acid mammary streptococci (500 diam.)
(*Bacterium OI IM Bacillus minimus mammae*)

and in stable dirt, to-day it must be considered an important factor both in sanitation and cheese-making.

COMPOSITION OF THE MAMMARY MICROFLORA.

The mammary microflora is very simple. Whereas in the teat microflora, as will readily be understood, the most varied species of microbe can be found, the organisms constituting mammary microflora can be connected with two bacterial species only: one, the more frequent, forming the usual mammary microflora, is represented by micrococci (mammary micrococci), the other, the less frequent, is represented by streptococci (mammary streptococci).

The mammary micrococci are characterised by the proteolytic-acid cocci discovered by me in 1901 (fig. 52) which, as I afterwards showed in 1902, may be divided into several types, differing not so much morphologically as physiologically; some liquify gelatine more or less quickly or slowly (fig. 52 A), others do not liquify it at all (fig. 52 B); some are colourless, others chromogenous, yellow or greenish; there are also intermediate and even fluctuating types possessing no differences sufficiently constant and passing easily from one to another type, and which are hence rightly termed *Micrococcus varians* (CONN, ESTEN and STOCKING, 1906).

The mammary streptococci (which culminate in the *Streptococcus mastitis*), also show various types, of which some are also proteolytic; one of the first examples of these is that minute proteolytic-acid rod-like form which was described by me in 1907, according to the nomenclature of the time, as *Bacillus minimus mammae*, but which to-day, as it is not sporogenous, I prefer rather to describe as *Bact. mammae* (fig. 53). It is comparable in form to the elongated lanceolate or fusiform cocci to be observed in *Streptococcus lactis* or *lacticus* which some also denominate *Bact. lactis acidi* or *Bact. Guentheri*; hence I place it among the mammary streptococci, regarding it as akin to that liquefying species of *Bact. Guentheri* which BURRI has also traced (1917) in the udder (*Strept. liquefaciens*, of ORLA JENSEN (1919), akin and not identical because the bacterium peptonises casein and also gelatine, whereas mine peptonises casein only; but these differences with regard to gelatine are met with also among types of other proteolytic organisms, and in the first place among the above-mentioned mammary cocci. Elsewhere I have shown that the failure to liquify gelatine is simply due to the fact that this substratum is not favourable to the development of the *Bacterium mammae*; the caseolytic enzyme, however, that the organism secretes in milk culture then shows itself capable of liquefying the gelatine. Moreover, among the typical mammary streptococci there are some which are incapable of developing on gelatine plates.

I have carried on my researches up to the present time, both on micrococci and mammary streptococci, examining more than 50 types isolated by myself and 10 types with which my colleagues (BURRI, EVANS, ALICE HARDING, HART, and ROGERS) favoured me; all the cultures were transplanted each week or fortnight into milk sterilised. I had noticed that milk sterilised in the autoclave. is ill adapted for determining the proteolitic properties of the bacteria. Naturally, there are also differences between one milk and another.

From all the observations taken I am inclined to consider that no well-defined difference exists between the micrococci and streptococci, for I noted a great variability in morphological characters, the cells of the one and the same type being sometimes isolated, sometimes coupled, sometimes grouped in three groups,in groups or short chains; side by side with spheroidal forms there are elongated forms; their dimensions vary from 0.5 to 13 μ.; all however are gram-positive. I found the same variety in physiological properties; the predominating types are proteolitic both on the gelatine and on casein. But in one and the same type, even in the same colony individuals are found which peptonise only the gelatine or the casein, which liquefy the gelatine slowly or quickly before forming visible colonies, which curdle milk quickly or slowly and also only after boiling, which peptonise milk slowly or at an early stage even without previous curdling, which re-dissolve the curd horizontally or laterally, which are colourless or chromogenous — white, yellow or citron. This explains why the mammary germs are described and named differently by various authors — who desired to name them: *M. lactis varians* Harrison and Savage, *M. lactis albidus* Conn, *M. lactis aureus* Esten and Mason, *Staph. aureus* Sadler, *Strept. liquefaciens* Orla Jensen, *Bact. Guentheri liquefaciens* Burri etc. For my part, from the latest investigations, I also renounce the names I had previously proposed, and prefer to call them simply *en bloc*: *mammary cocci.*

Besides the above-mentioned micrococci and streptococci, no other organisms have been found in the stable mammary microflora except the abortion bacterium, which some identify with *Micr. Melitensis*; but the latter being pathogenic is outside the scope of my investigations. All the other microbes which may be found in the primary microflora, that is, in the milk obtained by antiseptic milking, should be classed with the flora of the milk ducts, which, being causal, is very varied and multiplex, just as is the flora of the air and of stable litter. Indeed, side by side with common organisms have been found zymotic germs of every kind, both useful, as the ordinary lactic ferments, and injurious, as the gasogenous or putrifying organisms found both among bacteria (*B. Coli-aerogenes*, *B. Proteus-Zopfii*) and among sporogenous bacilli (butyric ferments, *B. Albolactis*); sometimes also chromogenous organisms (*B. Syncyaneum*) or saccharomycetes, and even actinomycetes (*Nocardia*). All this flora has been found in milk obtained by antiseptic milking, but limited to the first drawings or at most to the middle drawings and very rarely found in the last drawings; in any case always in a transitory and never in a permanent state, thus showing that it is not capable of settling in the glandular parenchyma. On the other hand the mammary cocci and streptococci show a surprising constancy for months and years in every individual udder, or rather in each quarter of the udder. And this constancy is one not only of quality but also of quantity, inasmuch as a certain quarter under normal conditions continually contains the same bacterial species in fairly equal numbers which fluctuate around an average figure. There are generally from 10 to 100 organisms per cc., sometimes there are even less than 10, and sometimes several thousands; only occasionally do they reach hundreds of thousands (Gorini, Burri).

It is also a noteworthy fact that the various quarters of one and the same udder rarely contain the same quantity of microbes; they generally show differences in quantity and quality not less than those in the udders of different cows; one of the quarters may contain coccic microflora, a second streptococcic microflora, a third, mixed microflora; one of the quarters may be poor, another rich, another very rich in flora and the last even amicrobic. So that each separate quarter of the udder acquires a microbic individuality such that generally in a herd under bacteriological control, the cow from which the samples come may be picked out, by basing on the microbic physiognomy of the four quarters, when once the microflora of the teats has been excluded.

ORIGIN OF MAMMARY MICROFLORA.

The different behaviour of the mammary microflora as compared with the milk duct microflora, showing that the latter differs from the former in not being able to settle fixedly in the glandular parenchyma, leads us to conclude that it is of a different nature. In fact, whereas the casual microflora of the milk ducts is evidently the result of external infection entering through the orifices of the teats, the origin of the mammary microflora admits of two hypotheses; either it also comes from external contamination, or from within the organism. It is a very complex question and difficult to resolve by experiment, seeing the abundant communication which the glandular tissues have with outside surroundings through the milk ducts. It is impossible, in the presence of a positive cultural result, to determine whether the microbes found in a particle of the glandular tissue do not come from the zone which has external communication, the more so that owing to the scarcity of the microbes in the tissue, considerable portions of it must be subjected to examination. Arguments may be adduced however in favour of one rather than of the other hypothesis. If contamination enters from outside, it must be admitted that selection takes place among the exogenous germs within the udder, whereby the two above-mentioned species only can thrive, adapt themselves, and live together in the glandular cells. It is known indeed that the penetration of outside organisms through the teats is followed by phenomena varying according to the number, quality and virulence of the microbes and the resistance of the animal; all the inoculation tests made however show that the mammary glands form a serious obstacle to the penetration and settlement of an external agent. If it is desired to set up specific inflammation of the udder, very heavy doses of infective virus must be injected into the teat; the glandular defensive reaction is expressed in a more or less pronounced inflammatory process which clearly shows itself when common microbes are inoculated, because these are destroyed more or less rapidly. The tests show indeed that it is impossible to cultivate any microbes whatsoever permanently; some authors have injected various bacteria into the udder without causing inflammation (*B. prodigiosum, B. fluorescens, B. exiguum, B. acidi lactici* and others, including the same cocci isolated from the milk obtained by antiseptic milking); they observed that the number of the organisms present in milk constantly diminishes after the beginning of the test and that the greater part of them have disappeared after some hours ; *B. prodigiosum* was seen to persist longer, even after 8-15 days, but then disappeared also. Thanks to this defensive reaction, ordinary external infection is generally limited in the lower region of the gland to a line not far from its point of departure ; how then, among exogenous organisms could the mammary micrococci and streptococci only be spared ? Perhaps through their greater adaptibility to the mammary surroundings, owing to their power of becoming anaerobes and to their resistance to the temperature of the organism ? But it is impossible that such qualities should be confined to these two species, for among the teat microbes were also found various anaerobic and heat resistant species. It is more feasible to regard them not altogether as saprophytes, but as attenuated races of parasitic species, capable of resisting the bactericidal properties of the organ ; and if inoculation with the respective cultures does not cause them to settle permanently in the udder, probably it is because they are weakened through artificial culture. Nevertheless, contrary to the common organisms of the air and the so-called stable cocci, for which they were sometimes mistaken, probably owing to their chromogeny and their weak acidifying effect on milk, they would always have certain special characteristics, such as facultative anaerobic properties, which comes first in importance, and then the caseolytic (GORINI) and lipolytic activities (BURRI), which in the stable cocci are absent or scarcely noticeable.

But the second hypothesis, not less acceptable, is that the mammary microbes come from within the organism, via the blood or lymph.

The impermeability of the normal intestine has been shown to be maintained even during the period of digestion, but the intestinal mucus, when irritated or slightly injured, allows access to some organisms, and particularly, indeed almost exclusively, to the intestinal cocci, the so-called enterococcus. This explains the contradictory results obtained by the author, by administering to the animals under test, pure cultures of certain bacteria, such as *B. prodigiosum* and *B. fluorescens liquefaciens*, which bacteria were sometimes found and sometimes not, after 2 or 3 days, in the marrow, the spleen, the kidneys and the milk ; everything evidently depends on the condition of the intestine, and, by analogy, also on the conditions of the epithelium of the mammary gland ; and both the passage and settlement of the bacteria must be facilitated by the parasitical nature of the bacteria themselves.

As a matter of fact, if virulent streptococci be inoculated into the blood-vessels of the rabbit, their elimination by means of the mammary gland takes place for a few days (STECK).

In this connection it is well to remember that many authors put the enterococcus on the same footing as *B. Guentheri* that we have put in the same category with the mammary streptococci, and that the enterococcus has also been recently proved to possess proteolytic rennet-acid properties like the mammary cocci.

It may be concluded therefore that both sources of origin, the exogenous and the endogenous, are admissible for the mammary bacteria, when the latter are taken as being attenuated pathogenic forms.

This conclusion is supported also by the normal intermammary presence of a decidedly pathogenic germ such as the abortion bacillus, analogous to *M. melitensis* ; here also some consider it to be an external infection (through the vagina, perinaeum, teats), based on the observation that the hind quarters of the udder are the first to be attacked ; which coincides with the general fact, that these quarters very often contain a much richer microflora than the front ones ; others consider it to be an internal infection, based on the observation that virulent abortion bacteria injected into the veins of goats appear in the milk within 24 hours.

PATHOGENIC CHARACTER OF MAMMARY MICROFLORA.

The admission of the parasitic nature of the mammary organisms at once brings them very near the pyogenous bacteria, the mammary micrococci being placed in the same group with the pyogenous staphylococci and the mammary streptococci with the pyogenous streptococci and this both on account of their morphological and their physiological affinities. It is admitted in fact that morphologically the micrococci should be grouped with the staphylococci ; the mammary micrococci also show types with yellow and lemon-coloured chromogenic tendencies like the pyogenous staphylococci, and vice-versa the pyogenous staphylococci also show types with proteolytic acid tendencies like the mammary cocci ; and similarly with the mammary streptococci.

There are not wanting, besides, examples of the inoffensive intramammary vegetation of highly virulent pyococci (STECK).

Not only is the permanent settlement of the above-mentioned organisms in the glandular parenchyma thus explained, but also their numerical constancy in every quarter, as well as the numerical difference between the different quarters of an udder.

For in the case of pyogenous forms, however non-virulent or but slightly virulent, it is only logical to admit : (*a*) that with their toxin they cause a permanent stimulus, which excites in the organ a microbicidal contra stimulus, whence between the action and reaction a state of constant equilibrium is set up, which explains the numerical constancy ; (*b*) that the richness of the mammary microflora is in direct ratio with the bactericidal power of the organ, in the sense that this power is the stronger as the bacterial content is more numerous ; that explains the numerical difference. If this were not so the bacteria would finally develop to such an extent as to cause inflammation. Therefore the organ must be considered as in a permanent state of irritation, so slight and chronic, as to be considered *normal*, since it retains its full regular functional capacity.

As soon as this equilibrium is lost however, whether by diminished organic resistance or by an exceptional growth of the mammary microflora, abnormal conditions are created whereby certain tendencies develop which may go so far as to become actual mastitis ; which leads us to recognise decisively that the mammary micrococci and streptococci are attenuated varieties of pyogenous species. Thus the unforeseen appearance of staphylococcic or streptococcic mastitis is accounted for, whether in cases of diminished organic resistance, as happens after digestive trouble, traumas, overwork or simply fatigue (*suspension of milk*), especially if accompanied by transitory hyperthermia, suffocating or sultry heat, general or merely local chills (the cow lying for instance on cold damp ground) ; or in cases of an exceptional growth of mammary microflora, as happens in consequence of retention or suspension of milking during lactation or during drying up. But here we enter into the pathological field, with fundamental alterations of the lactic secretions, which are outside the scope of my work.

There are nevertheless cases of abnormality of the mammary microflora which do not cause apparent inflammation or alterations of the lactic secretion, but which nevertheless are factors in the preservation of the milk and preparation of milk products. These cases were explained by my investigations on the relation between mammary microflora and cheese-making.

RELATION BETWEEN MAMMARY MICROFLORA AND CHEESE-MAKING. UNDER NORMAL CONDITIONS.

When in 1892-94 I had shown the existence of rennet-acid bacteria capable of dissolving casein in acid reaction, I perceived in them a special aptitude to help in the process of cheese-ripening, and therefore advanced my *proteolytic acid* theory on this ripening, which reconciled the two conflicting theories as to the simple lactic ferments (FREUDENREICH) and the peptonising ferments (DUCLAUX), adherence to which split investigators into two camps, and which were insufficient to explain the ripening process, since neither the lactic ferments of FREUDENREICH nor the peptonising ferments of DUCLAUX are capable of dissolving casein in an acid medium. In further support of my theory I proved in 1897 that as high temperatures were favourable to saccharolytic activity, low temperatures were favourable to the caseolytic activity of bacteria, such low temperatures as are met with during the ripening of the cheese. And when in 1901 I had proved that proteolytic rennet-acid cocci generally exist in the udder, I deduced thence that the milk issuing from the udder already contains bacteria and enzymes favouring its transformation into cheese. Such cocci indeed are met with in all cheeses and, like the mammary cocci, do not belong to one but to several types, of which I described the two principal under the name of *M. casei acido-proteolyticus* I, fig. 52-*A* (which liquifies gelatine), and *M. casei acido-proteolyticus* II, fig. 52-*B* (which does not liquify it). Such variability of the cheese cocci has also been recognised by several authors.

The cheese cocci are met with in large quantities in the first stages of ripening (fig. 54); afterwards they gradually diminish, without, however, ever disappearing altogether, except perhaps in the case of cheeses of large size, made at high temperatures such as the Emmenthal cheeses, in which it may be concluded that the high temperature, which continues long after their preparation, and the degree of acidity which consequently increases very quickly, hinder the development of these cocci. It should however, be noted that even where a premature disappearance of these microbes takes place, the action of their caseolytic enzymes is maintained and con-

PLATE XXII.

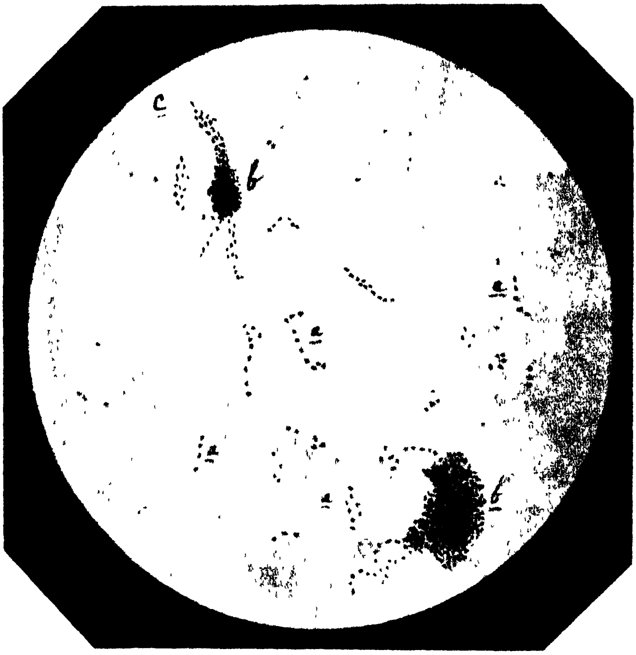

FIG 54 — Caseary microflora

Section of Grana cheese — (500 diam)

a) disseminated bacteria ; *b*) accumulated bacteria ; *c*) serose

tinues even after the death of the cells, similarly to what is observed in cheeses ripened at a high temperature, where the bacteria in general diminish more quickly than in cheeses ripened at a low temperature, and yet the increase in ammonia continues, even after the bacteria have almost disappeared. And in support of the theory as to the help rendered by such cocci to cheese-ripening, I have also shown that they and their proteolytic enzymes are able to carry on their function even at the low temperatures at which the majority of cheeses are ripened. It should be added that in all probability to the same mammary cocci is due the production of *galactase*, a so-called proteolytic enzyme, pre-existent or natural, discovered in milk by BABCOCK and RUSSELL in 1897, that is, before the existence of proteolytic cocci within the udder was proved by me, whence the American discoverers considered it to be of primitive cell origin. As is now known, the American school, and after them several European authors also, assign an important part to galactase in the digestion of the casein both in hard and soft cheeses. Also the fact that galactase has not always been found in milk obtained antiseptically, favours its bacterial origin; these are evidently cases of extremely poor mammary microflora; it has also been found that the milk of the quarters rich in mammary microflora contains a larger quantity of soluble nitrogen as compared with the quarters poor in bacteria (KÖSTLER). It should be added finally that such cocci by peptonising the casein render it utilisable by the simple lactic ferments, thus facilitating the ripening process.

These reasons make it evident that the proteolytic-acid cocci of the udder, in the mass, that is in all their varieties, should be considered as necessary factors of cheese-ripening in general.

Another useful function of the mammary cocci may be perceived in the fact that their digestive enzymes can be placed among the factors of the well-known greater digestibility of entirely new unboiled milk as compared with boiled milk, in which the enzymes are weakened, and this applies especially in the preparation of sanitary milks obtained antiseptically, where the mammary microflora can come into play, not being overcome by the secondary microflora.

It may be said also that in the case of other milk enzymes, the question has arisen as to whether they are not of microbic rather than cellular production; this applies especially to catalysis, which the proteolytic lactic ferments gave shown themselves capable of producing, in contrast to the simple lactic ferments.

ABNORMALITY OF MAMMARY MICROFLORA.

The mammary microflora have so far, been treated under normal conditions, in which it can and should be considered as without effect on the udder and useful in cheese-making and for milk consumption. But in suceeding works several cases have been indicated in which the microflora should be considered as abnormal and injurious. Cases of disease and of evident inflammation of the udder are excluded; here a decidedly pathological field is entered upon; mastitis or mammitis will definitely affect milk secretion by virulent pyogenous bacteria or specific morbid organisms (tuberculosis, epizootic aphta, small pox, vaccin, etc.).

My investigations have shown that the mammary microflora may be in an abnormal condition without the organ being greatly inflamed. This fact, to which my work first drew attention, has not only been amply confirmed, but considerably developed by various scientists, by whom it has been shown that cows rarely have udders of which all the quarters have a normal microbic content ; at least one of the quarters, although there is nothing to show that it is in a different condition from the others, though it yields apparently normal milk, has a microflora not only abnormal but persistently abnormal. The phenomenon of constancy which we saw was one of the characteristics of microflora in a normal condition, is repeated in that of an abnormal condition.

It is a question not only of quantitative but also of qualitative abnormality, not in the sense that there are unusual species, for then we should be entering on the pathological field, but in the sense of such an increase or decrease of the activity of the usual microflora as to become dangerous or injurious, without however attaining pyogenous properties sufficient to cause mastitis.

As determining causes of similar slight abnormalities I have pointed to the slight cases of stagnation or lactic obstruction in the udder in consequence not of a suspension of milking, but simply of imperfect or incorrect milking. By *imperfect milking* is implied that the milk is not completely drawn from the udder especially at the conclusion of milking. By *incorrect milking* is implied that the milk is partially withheld by the cow owing to ill treatment during milking, ; it is a well known fact that all ill treatment, such as fright during milking, as also the preliminary palpations with which the milker seeks to draw the lactic secretion, if carried out roughly or to excess are liable to cause a retention of milk.

Such lactic retentions are generally transitory and pass almost unobserved by the milker, and yet whenever the milk remains in the udder longer than the normal period between each milking, it influences both the number and virulence of the mammary bacteria, because during lactation organic resistence is easily weakened, whence insignificant causes are sufficient to intensify microbic activity.

This explains the increase of the mammary bacteria following on too prolonged pre-milking palpations; hence it is advisable to reduce to a minimum the cleansing operations prescribed for antiseptic milking; however, if milk retention did not enter into the question here, both palpations and washing would have an opposite effect, as they increase the circulation of the blood and thereby the activity of the antimicrobic factors.

The increased microbic development has injurious effects on the udder and on the milk. Such effects are more serious when caused by mammary streptococci, the action of which is analogous to that of the ordinary microbes, but more intense, in that they cannot indeed remain long and in great abundance with impunity in a state, so to speak, of latency like that of the ordinary cocci; that is they are more sensitive to milk stagnation, whence they more easily give rise to a transient form of mastitis, which passes off without needing special treatment beyond more frequent and delicate action in final milking; a pure culture of *B. mammae* was found in one of these cases of transitory mammitis.

The injurious effect of imperfect or incorrect milking is more marked in the case of cows which usually show unwillingness to give milk, or when physiological causes of milk retention are present, such as a diminution of the rate of secretion, especially during the drying off of the udder.

The facility and rapidity with which the numerical oscillations of the mammary microflora and especially of streptococci, can make the mammary infection pass abruptly from the physiological normal state, to the abnormal, if not yet pathological, state, which then abruptly becomes normal again, are remarkable. To detect such numerical oscillations, slight, unnoticeable causes are sufficient, such as the inevitable stagnations which take place spontaneously during the drying off of the udder; these stagnations generally disappear at calving or with the new lactation period, in spite of the persistent mammary microflora, in which however a tendency to a beneficial change is to noticed when the usual micrococci get the upper hand of the streptococci. On the other hand these stagnations are aggravated when bad drying off preparations intervene with suspensions or insufficient milking, or when these preparations are carried out in udders or udder quarters which have already suffered from incorrect or imperfect milking during lactation.

The danger of the stagnations thus increases, progressively increasing the predisposition to stagnation, and the extent of the consequences following thereon through the mammary microflora, the result being cows which are peculiarly sensitive to lactic obstructions, or as the Germans say, *stauungsempfindlich*. So that it may be said that the stagnation mastites are exclusively in the udders or udder quarters possessing a definite bacterial character, a definite and especially streptococcic microbic history, and that the microbic stagnations, if they existed, would pass off harmlessly. This explains why there are quarters which repeatedly are more open to bacterial invasion, and why certain mammary diseases attack only one quarter, leaving the others immune.

The contrary hypothesis has also been advanced, that is, that the mammary bacteria are left after a progressive mastitis which may have passed unobserved and has then become normal ; but this hypothesis, if it should not always be entirely rejected, can no longer be held after the generalisation of the mammary microflora has been demonstrated even in the most healthy udders, that is those which are not only not in a stagnant state, but which have never previously suffered stagnation nor are liable to it. Unfortunately, after what has been said above, it is obvious that to be sure of finding such udders they must be limited to those of the first lactation and that they become more and more rare with successive lactations. This agrees with the practical observation that the milk of cows which have calved several times shows increasing resistance to fermentation, that it loses its cheese-making quality, though retaining a normal appearance, owing to the effects caused by the abnormal mammary microflora. The best dairies for cheese-making are those which chiefly contain first-or second-calving cows.

Some authors ascribe the success in cheese-making during the war, to the elimination of the older milch-cattle, in spite of the deficiency of the cow-house and dairy staff (KÖSTLER).

INFLUENCE OF MAMMARY MICROFLORA ON CHEESE-MAKING UNDER ABNORMAL CONDITIONS.

The effects produced on milk by abnormal mammary microflora consist principally of enzymotic modifications which may be connected, both directly and indirectly, either with a numerical increase or with an increased activity of the mammary bacteria. The direct effects depend on the fact that the milk, though of normal aspect, issues from the udder exceptionally charged with the bacteria themselves or with their respective proteolytic rennet enzymes; the indirect effects depend on the fact that the unusual number or virulence of the mammary bacteria, though not causing actual disease of the udders, cause an excitation, a deviation of their functions, whereby the milk is secreted in a still apparently normal state but modified in its internal enzymatic constituents.

These are modifications which escape observation both under the organoleptic inspection and the ordinary chemical analysis, but which influence the fermenting activity and the cheese-making quality of the milk, as may be observed from its tendency to decompose and its behaviour with rennet, in the zymoscopic-lactic and curdling tests.

In the zymoscopic-lactic test the influence of these modifications is shown in two ways: by the *premature curdling* and by the decomposition of the milk; the latter, according as the curdling or the dissolving action of the mammary microflora prevails, either curdles prematurely, that is before having attained the necessary degree of acidity (*premature curdling*, followed by peptonising), or suddenly becomes soluble even without previous curdling (*dissolution*). Both these phenomena are favoured by the incubating temperature so that they become quite evident at 37-38° C., in which they appears in the course of only 10-12 hours (whereas a normal milk keeps for 24-36 hours). In the case of milk kept at the maximum summer temperature, however, and when subjected to heating for domestic use or cheese-making (as in the manufacture of the Grana cheese), these phenomena may take place prematurely, causing a notable shortening of the period during which the milk may be kept and utilised, with an economic loss to the producer and consumer, not only a financial loss, but the loss of a food for which there are no substitutes.

It is not to be inferred that such phenomena are not often due to the occasional and secondary microflora, but merely to state that the mammary microflora must be considered as the cause of the loss and waste of milk, even when it is produced with adequate precautions against outside contamination. This matter should be inquired into by the United States where regulations are in force as to the "period of usability" of the milk obtained by antiseptic milking.

In the rennet test, the modifications of the milk appear in two forms, and influence the time occupied in and manner of curdling; the milk is late in curdling or the curd is deficient in plasticity and solidity, does not cut cleanly, frees itself from the whey with difficulty and gives a whey as if only a part of the milk were curdled. The consequences of such abnormalities are that the cheese, insufficiently drained, is predisposed to swelling and rotting; besides the whey in the vat, there is an accessory curdling whereby little clots are formed which no longer combine with the principal part of the curd and form the so-called grains, which pass through the meshes of the strainer, causing a loss in yield of cheese.

The worst feature is that the enzymotic modifications of the milk are not revealed under organoleptic examination, hence the cheese-maker does not notice them until the fermentation stage, or even after fermentation, through the success or otherwise of the results. Certain criterions, are given, it is true, which may lead one to assume their existence, as for instance the presence in the milk of stringy particles, which, however, if not sufficiently large, are not easy to observe, because they do not form a sediment, even when passed through the strainers or filters used for purifying the milk; further, these particles, which consist of masses of leucocytes inherent in the increased cellular reaction through abnormal mammary microflora, do not appear when the microbic abnormality is transitory and the stagnation does not invade the larger milk ducts.

Another criterion might be an increased initial acidity of the milk, which to be of any value should be determined immediately on milking and not simply with the organoleptic aids and with litmus paper, but with the acidimeter; the mammary bacteria however are rarely strong acidifiers; the mammary streptococci themselves, including the *B. Guentheri* or common lactic ferment variety, have proteolytic rather than saccharolytic properties; hence even when in large numbers they do not cause active lactose fermentation, and the milk acidity is rarely increased through the mammary microflora.

A better criterion may be that of tasting the milk when it has assumed a special bitter flavour, thereby approaching what the Germans call *rässsalzige* or *salzig bittere Milch* (salt bitter milk), which is due to mammary inflammation or true stagnation mastitis, where the milk is decidedly salt, bitter and alkaline, and also has a different aspect and a slightly brownish-yellow colour, showing real modifications in its chemical composition (increase of sodium chloride, decrease of lactose and acidity, deficiency of salts of lime, etc.). The milk, obtained towards the end of lactation, when drying off is disturbed by the mammary microflora abnormalities, has a tendency towards *rässsalzige* characters; whereas milk yielded during a physiologically normal drying period has characters rather approaching those of the colostrum. It is thus confirmed that milk with abnormal mammary microflora is a beginning, a preliminary stage of pathological milk, which is produced by accentuated secretion disturbances. It should be remembered that the *rässsalzige* milk also has a high microbicidal power, showing a diminished tendency to bacterial growth, which evidently influences the natural selection and later development of the microflora in the milk.

All this, even in a slight degree, if not sufficient to cause the milk to be withdrawn from direct consumption, is nevertheless sufficient to cause the cheesemaker a series of unforeseen difficulties, which may lead him into error or oblige him to adopt other methods of fermentation; in either case unfavourable results are caused on the quality of the products. Unfortunately, it is this kind of milk, apparently normal, but fundamentally modified in its fermentative qualities, which proves most deceptive in cheese-making, because it is the most difficult to reject when sent to the cheese dairy, the more so that the decomposition scarcely ever affects all the milk of a cow, and still less all the milk of a herd, or the greater part of it, but the milk of certain individual quarters. Further, such milk as is already defiled when it issues from the udder is more dangerous than a milk which becomes defiled after milking, for the modifications which have taken place within the udder can no longer be corrected, whereas subsequent contaminations can be rendered harmless by the aid of timely refrigeration or pasteurisation. I have observed, for instance that such milk even resists the beneficlal influence of ferments selected in cheese making.

It might be thought that when the proportion of abnormal milk is small as compared with that of normal milk, mixing with the latter serves to neutralize the pernicious effect of the former ; but this is not the case, or at least not so altogether. In the less serious cases the cheese, if not a complete failure, turns out to be defective in some part, either in the centre or surrounding areas, thus justifying the opinion of experts that the "infected" milk settles in some parts of the curd and there causes isolated abnormal fermentations, which give rise to partially spoiled cheeses, either rotten in certain parts of the inside or rind (serious spots or holes) or with stringy or spongy masses or cavities or circumscribed fissures, etc. The writer's opinion, based on experience, is that the causes of such failures in cheese-making are more often than is believed, due to mammary microflora in an abnormal condition.

MILK TESTING AS REGARDS MAMMARY MICROFLORA.

Whenever failures in ripening cannot be attributed to other evident or probable factors, when, especially, there are faults in curdling (tardiness, slowness in hardening, difficult clearing of the curd), which point to an anti-curdling or dissolving principle, an investigation of the microbial and fermentative conditions of the milk of every single cow, even of every single udder-quarter, becomes necessary. This test should be based on the microscopical examination together with zymoscopic and curdling tests and should be *carried out on milk just obtained by antiseptic milking, the first jets having been rejected.* The bacteriological analysis alone is not sufficient because the artificial means of culture do not always allow all the mammary bacteria, especially the streptococci, to develop ; further there may be bacteria which, even in relatively small numbers exert considerable enzymotic action, and attention is drawn in this connection to the disproportionately dissolvent coccus described by the writer in 1902, which formed liquefaction rings on the gelatine slides even before the formation of visible colonies.

Also the zymoscopic test alone is not sufficient, because there are cases, though rare, of rich mammary microflora in which the milk keeps for a long time as under normal conditions (microbicidal phenomena ?) though proving unfit for cheese-making, by the rennet test, which is really one of the most sensitive and should be constantly employed.

Other tests may be helpful, such as the catalysis test, whether the catalysis be of cellular or microbic origin, the direct microscopic examination of the milk for leucocytes (BREED), the richness of which is generally in proportion to the microbic richness, but when stagnation is limited to the wide milk ducts with an increase of migratory bacteria, it may not be accompanied by corresponding leucocytosis.

Such zymoscopic microscopic control of the endomammary microbial conditions has been advised by the writer for some time, even as a preliminary measure, in order to obtain a healthy *selection of cows*, selection being based on their mammary microflora, especially for the so-called sanitary milk obtained by antiseptic milking and used as children's and invalids' food, whether given raw or pasteurised or sterilised. The writer has shown the peculiar resistance that the mammary bacteria, though not sporiferous, offer, owing to the coating of casein which they acquire through their own coagulating enzymes. This proposal met with the approval of the International Dairy Congress at Bern in 1914, as a subsidiary measure for the veterinary control of milk in view of the connection between the abnormal conditions of the mammary flora and the predisposition of udder to inflammation. Such control should also be instituted in the sale and purchase of, and prize competitions for cows, in view of the quantitative and still more the qualitative persistence of the mammary microflora in certain cows, which is such as to be a more or less permanent characteristic, probably connected with almost abnormal individual conditions, though free of disease.

The microscopic zymoscopic control of milk in connection with mammary microflora should also serve as a standard in the improvement of the herd. The harmful effect of the mammary microflora during the drying off period of the udder increases its liability to stagnation and heightens the anticaseous consequences and should especially be borne in mind.

To combat the dangers of the mammary microflora it is necessary above all to instruct the dairy staff in the care of the udder and in milking. It is not sufficient that milking should be carried out with due regard to cleanliness (the washing of hands and udder) to prevent the milk being infected from outside and through the teats, the more so that the possibility is by no means excluded that the mammary infection comes rather from within through the lymph and blood; but the milking should be carried out correctly and completely, to prevent those stagnations which render the mammary microflora injurious and cause it to pass from the normal to the abnormal state, whether it comes from outside or from within the organism.

In a word, the staff should be instructed that the mammary microflora does not depend so much on the hygienic conditions of the cowhouse and the cows as on milking.

SUMMARY.

The mammary microflora, to which the writer was the first to call and sustain attention both in connection with sanitation and cheese-making, has now been definitely shown to possess the following characteristics constant settlement in the mammary parenchyma, typicalness, quantitative and qualitative constancy, parasitic nature, importance in cheese-making. It is thus distinguished from the microflora of the air and cowhouse dust and dirt, which may be found in the lower excretory ducts of the udder.

The mammary microflora is essentially formed of micrococci and streptococci which are characterised by proteolytic acid and lypolitic activities and are related to the *Staphylococcus pyogenes* and *Streptococcus pyogenes* species, of which they may be attenuated types, coming from outside or from within the organism.

Owing to the great morphological and still greater physiological variability of these bacteria, whence they have been described and named differently, they can be conveniently termed *cocci mammarii* authorities.

The mammary microflora, which under normal conditions must be considered as having no injurious effects on the udder and as useful in cheese-making, may, under abnormal conditions, become injurious to the extent of causing mastitis. Before however assuming pathogenical properties against the organ, it may, owing to the number and virulence of the enzymes become injurious to the preservation and fermentation of the milk, both from the direct action of the mammary bacteria in the milk and from the cellular reaction caused by them within the udder, whereby the latter, though apparently healthy, has its functions altered so that it secretes milk which, though apparently normal, is affected in its fermenting and cheese-making properties to such an extent as to cause more loss than is believed of milk and failure in cheese-making and in the preparation of sterilised preserved or condensed milks.

To determine the abnormal conditions in the mammary microflora having anticaseous effects on the milk, the obvious causes (digestive troubles, chills, fatigue, etc.) are not exclusively necessary; the lactic states which follow, unfortunately too frequently and unforeseen, imperfect and incorrect milking are sufficient; hence to produce milk, healthy and good for cheese-making, clean and antiseptic milking is not sufficient; in addition milking must be carried out completely and correctly, it being borne in mind that the primary mammary microflora depends on the milking.

To control the fermentative and caseous properties of the milk, which depend on the mammary microflora, the ordinary chemical-organoleptic examination is of little use; it needs a complex zymoscopic-microscopic and caseo-zymoscopic examination of the milk taken antiseptically from separate quarters of the udder, the first jets having been excluded.

This method of investigation will supply valuable criterions, both for explaining failures in cheese-making, and for the acquisition, award of prizes for and renewal of milch cows as well as for their selection for cheese-making, and especially for the preparation of hygienic preserved milks.

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BIBLIOGRAPHY.

Arbing, *Jahresb. f. Gärungsorganismen*, 1903, 14, p. 374.
Backhaus and **Appel**, *Ber. d. landw. Inst. in Konigsberg*, 1900 and 1903.
Barthel Chr., *Revue générale du Lait*, I, 1902, pp. 505-529.
Basset and **Carré**, *Comptes Rendus, Soc. Biologie*, 1907.
Bergey, D. H., *Bull.* 125, *Dept. of Agric.* Pa., 1904.
Boeckloout and **De Vries**, *Revue gén. du lait*, 1912, 9, p. 169.
Bolley and **Hall**, *Centralbl. f. Bakt.* II Abt.,, 1895, 1, No. 22-23, pp. 788 and 795.
Breed, R. S., *Journ. infect. dis.*, 1911, 7, p. 632.
— *Archiv. f. Hyg.* 1911, 75, p. 383.
— *N. Y. Agric. Exper. St. Bull.* 380, 1914.
Breed and **Baker**, *N. Y. Agric. Exper. St., Geneva, Tech. Bull.* 80, 1920.
Burr, R. H., *Centralbl. f. Bakter*, 1902, 8, p. 236.
Burri, R. Berlin. Molker. Zeit., 1903, 13-14; *Landw. Jahrb. d. Schweiz*, 1917, 30, p. 315.
Burri and **Hohl**, *Schweiz. Milchz.*, 1916, Nos. 3-8.

Conn, Esten, Stocking, *Rep. Stows. Agric. Exp. St.*, 1906, pp. 92-203.

Cooledge L. H., *Michigan Agric. Exp. St. Tech. Bull.* 33 and 41, 1918.

De Graaf and Schaap, *Ann. des Falsific.*, year 6, 1913, 72, pp. 639-645.

Dinwiddie, R. R., *Bull.* 45 *of the Arkansas Agric. Exper. St.*, 1900.

Düggeli, M., *Zeitschrift f. Gärungsphys.*, 1916, 5°, p. 321.

Esten, W. M., 9° *Ann. Report of the Storrs Agricult. Exp. St.*, 1896.

Evans Alice, *Journal of Infect. Diseases* 18° and 22°, 1916 and 1918.

— *Revue Générale du Lait*, 1904, 3°, p. 416.

Gorini, C., Studi sperimentali sul latte. *Atti dei Labor. Scient. della Sanità Pubblica*, Rome, 1892.

— *Rivista d'Igiene e Sanità Pubblica*, Rome, 1893, IV.

— *Hygien, Rundschau*, 1893, III, p. 381.

— Sopra una nuova classe di batteri coagulanti del latte, *Giorn. R. Soc. It. Igiene*, XVI, 1894.

— Sulla batteriologia del caseificio, *Boll. Uff. Min. Agric.*, Rome, 1897.

— *Annales de Micrographie*, Paris, 1897, IX, p. 433.

— I batteri acidopresamigeni del latte. *Rend. R. Ist. Lomb. Scienze e Lettere* 34, 1901.

— *Landw. Jahrb. d. Schweiz*, 1902, p. 22.

— *Centralbl. f. Bakter.* II Abt., 8, 1902, p. 139.

— *Revue Gén. du Lait*, 1902, 1, p. 169.

— *Milchw. Zentralbl.*, 1905, 1, p. 494

— Sui batteri dei dotti galattofori delle vaccine. *Rend. R. Accad. Lincei*, 1902, XI, p. 159.

— I batteri acidopresamigeni del latte in rapporto all'igiene della mungitura. *Rend. R. Ist. Lomb. Sc. e Lett.*, 39, 1906.

— *La Clinica Veterinaria*, 29°, 1906. *Revue Gén. du Lait*, 1907, 6°, p. 179.

— Il bacillus minimus mammae, n. sp. *Rend. R. Ist. Lomb. Sc. e Lett.*, 40°, 1907. *Revue Gén. du Lait*, 6°, 1907, p. 553.

— L'importanza igienica dei miei batteri acidopresamigeni delle mammelle. *Comunicazione al 6° Congresso Intern. di Latteria*, Berna, 1914. *La Clinica Veterinaria*, 1914, 38, p. 707

— L'alimentazione delle vaccine e la produzione igienica del latte. *Rend. R. Ist. Lomb. Sc. e Lett.*, 47°, 1914, p. 288.

— Sulla termoresistenza di batteri non sporigeni nel latte. *Rend. R. Ist. Lomb. Sc. e Lett.*, 48°, 1915, p. 956.

— Studi sulla produzione igienica del latte. Importanza e controllo della microflora mammaria per la selezione delle lattifere. *Rend. R. Ist. Lomb. Sc. e Lett.*, 49°, 1916, p. 480.

— Sulla diffusione della proprietà acidopresamigena proteolitica fra i batteri. *Rend. R. Ist. Lomb. Sc. e Lett.*, 56°, 1923, p. 994. — *Le Lait*, 4°, May 1924.

Guillebeau, A., *Landw. Jahrb. d. Schweiz*, 1890, 4, p. 27, and 1891, p. 68.

Harding and Wilson, *Techn. Bull. Geneva Agric. Exper. Stat.*, 1913, 27.

Harrison, *Révue Gén. du Lait*, 1902, pp. 457-538.

— *Centralb. f. Bakter*, II, 1905, 14°, p. 365.

Harrison and Cumming, *Journ. of applied microsc.* Vol. 5, 1901, p. 2029.

Harrison and Savage, *Révue Gén. du Lait*, 1912, 9, p. 121.

Hastings and **Hoffmann**, *Bull. Wisc. Agr. Exper. Stat.*, 1909, 6, p. 189.
— *Centralbl. Bakter.*, II, 1910, 25, p. 465.
Henderson and **McConkey**, *Journ. of Hygiene*, 1906, 6, p. 385.
Orla Jensen, *Die Bakteriologie in der Milchwirtschaft*, Jena, 1913.
— The lactic acid bacteria, Copenhagen, 1919.
Jones, F. S., *Journ. of Exp. med.* 1918, 28°, pp. 149, 253, 721 and 735.
Kitt, Th., *In Koll. Wassermann, Pathogen. Mikroorganismen*, 1913, VI, p. 112.
Kolle, W., *Klin. Jahrb.* Jena, 13°, 1904, p. 3.
Koestler, G., *Schweiz. Zentralbl. f. Milchw.* 1921, No. 5 and seq.
Koestler, G., **Elser** C., **Lentann**, W., *Landw. Jahrb. d. Schweiz*, 1922.
Koestler, G., **Steck**, W., **Radosaolevitch**, M., *Landw. Jahrb. d. Schweiz*, 1921.
Kufferath, H., *Ann. Inst. Pasteur*, 1921, 25, p. 167.
Kuntze, W., *Centralbl. Bakter*, II, 1908, 20, p. 420.
Löhnis, F., *Hildesheim, Molkerei Zeitung*, 1914, 28°, in *Centrabl. f. Bakter.*, 2° Abt. 18, 1907, p. 140 and 43°, 1915, p. 279.
Lux, A. *Centr. f. Bakt.* II, 1903, II, p. 273.
Marshall, Ch., *Mich. Agr. Exp. St.* Bull. 1900, 182.
Monvoisin, A., *Le Lait*, Paris, Azzelin et Houzeau, 1920, p. 172 and seq.
Moore, V. A., 12° and 13° *Ann. Report of the Bureau of An. Ind.*, U. S. Dept. of Agric., 1899.
Puppel, *Zeit f. Hyg.* 1912, 70, p. 449.
Rogers and **Dahlberg**, *Journ. of Agric. Res.*, 1914, p. 491.
Rullmann and **Trommsdorff**, *Arch. f. Hyg.*, 1906, 59, p. 224 and 1911, 73, p 81.
Russell and **Hastings**, *Rep. of Wisconsin. Agr. Exp. St.*, 11°, 1894, p. 150, and 21, 1904, p. 164.
Sadler, W. and **Mounch**, M. J., *Scientific Agriculture*, March, 1922.
Savage, W. G., *Rep. Med. Officer*, 1906, 1908, pp. 3-50.
Sherman and **Hastings**, *Milchw. Central*, 1920, 49, p. 80.
Schulz, *Archiv. f. Hyg.*, 1892, 14°, p. 260.
Steck, W., *Schweiz. Zentralbl. f. Milchw.* 1920, No. 38 and 39, Landw. Jahrb. d. Schweiz, 1921.
Tartler, G., *Centr. Bakt.* II, 1912, 33, p. 368.
Trommsdorff, *Centr. Bakter.*, II, 1912, 66, p. 505.
Ward, A. R , *Bull.* 178 *of the Cornell Univ. Agric. Exp. St.*, 1900.
— *Journ. of applied microscopy*, I, 1901, p. 205.
Ward, A. R., and **Moore**, V. A. *N. Y. Agric. Exp. Stat.*, 1899, *Bull.* 158.
Ward, A. R., and **Reed** R. C., *Centralbl. Bakter.*, 1901, 30, p. 83.
Williams, R. **Stenhouse**, *Journ. R. Agr. Scty. England*, 1917, 78°, pp. 1-11.
Willelm and **Miele**, *Rev. Gen. Lait*, 1904-05, 4, p. 409.
Winslow, **Rothberg** and **Parson**, *Journ. Bact.* 1920, V, 2, pp. 145-167.
Zschokke, C. *Schweiz. Archiv. f. Tierheilk.*, 1904, 46, p. 113.

THE PHYTOPATHOLOGICAL PROBLEM IN BELGIUM.

Different countries naturally take different parts in the conspicuous efforts that are now being so generally made to develop Phytopathology in its applications to Agricultural Science.

It is extremely interesting to see the comparative studies of the hygienic conditions of the crops in the various countries that are being carried out with all the care and thoroughness that scientific method requires, and also the reports that are issued on the policies pursued in regard to crop protection, as well as on the further developments which appear to be desirable in the future.

Such work can lead only to a healthy rivalry ; progressive countries find therein the sanction for their labour and efforts, the more backward an incentive to activity, and thus the elements of valuable mutual instruction for all are introduced.

Hence on all general grounds I cannot but be glad of the opportunity of addressing you on the Problem of Phytopathology in Belgium. My pleasure is however somewhat tempered, for against my patriotic inclination, it has to be admitted that in this respect my own country of Belgium takes but a humble place among the nations.

In Belgium, questions relating to plant diseases have not up to the present aroused the interest shown in them in other progressive countries.

There are, perhaps, extenuating circumstances to account for this comparative indifference.

First, the conspicuous success in most forms of plant production is the reason why so little interest is taken in factors which appear to be of secondary importance in obtaining a high yield ; there is also the fact, as will be clearly shown, in the account that will be given of the hygienic condition of the crops, that there are hardly any instances in Belgium of those really dangerous epiphytes which cannot fail to arouse public opinion and cause action to be taken by the authorities.

This comparatively privileged position is due to various causes: first to the fact of a temperate climate, with no extremes, and favourable to plant growth and also incompatible with any special development of parasitic growths, and secondly to the great variety of crops, the result of which is that epiphytes do not find material in abundance for their greater diffusion such as exists in countries where there is a more or less characteristic monoculture covering large areas.

In any case, a certain feeling of security has thus been created in Belgium, which is somewhat prejudicial to the success of a campaign for the complete and systematic organisation of the protection of plants, the importance of which has long been fully appreciated by countries that have suffered severely from cryptogamic and insect pests.

After this introduction, I now propose to make a brief statement on : (1) the hygienic condition of the principal crops cultivated ; (2) the organisation for the protection of crops.

(1) Hygienic conditions of crops cultivated

Agricultural Crops.

(a) *Cereals.*

Wheat. – The greatest enemy of wheat is Caries, which still causes an average loss of 5 % of the yield, especially in the case of crops grown on a small scale. On most of the large farms, the seed is very frequently disinfected either by copper sulphate (immersion or spraying) or by formalin.

Take-all, caused by *Ophiobolus graminis*, much more seldom by *Loptopsphaeria culmifraga*, comes second in importance ; after mild winters and wet springs it sometimes assumes very destructive proportions ; this was the case in 1923.

Naked smut, caused by *Ustilago Tritici*, is rarely widespread.

Only in very exceptional cases is wheat seriously affected by rust. Whereas brown rust (*Puccinia triticina*), the development of which is but little affected by meteorological conditions, appears every year, and only causes very slight damage, yellow rust (*Puccinia glumarum*) and black rust (*Puccinia graminis*) are more inconstant and at the same time more destructive. The former mostly makes its appearance after a cold wet spring (1923), when it is frequently met with in abundance on the stems but only rarely attacks the ears and never so intensively for instance as in Scandinavian countries. *P. graminis* develops during the years in which vegetation and maturation are delayed by prolonged summer rains (1924), without however generally assuming a disquieting epidemic character.

Barley. — Naked smut (*Ustilago nuda*) and covered smut (*U. Hordei*) are often co-existent in the fields, the second being generally more abundant. But the cryptogamic disease most destructive to barley is, without question, Helminthosporiosis (*Pleospora trichostoma*) which sometimes destroys as much as 25 % of the ears. In spite of the propaganda carried on as to the value of disinfecting the seed, up to the present this is not done on a large scale.

Rusts cause little damage to barley. Dwarf rust (*Puccinia simplex*) appears every year, but is almost innocuous, while yellow and black rust are rare.

Rye. — Stem smut (*Urocystis occulta*) is frequently met with but always in small quantities. Crops are generally free from ergot (*Claviceps purpurea*) ; here and there it is met with to a small extent.

The leaves of rye are often extensively affected by *P. dispersa*, through the crop does not suffer greatly therefrom ; *P. glumarum* is very rare on this cereal and *P. graminis* is met with under the same conditions as in the case of wheat.

Oats. — This cereal is often quite immune from cryptogamic attack. Smut, caused only by *Ustilago Avenae*, is sometimes met with in small quantities. *Helminthosporium teres* var. *Avenae* is sometimes rather abundant and causes partial sterilisation of the panicle. Among rusts, crown rust (*P. coronifera*) is most frequent, black rust being abundant only on late crops which have been subjected to the action of prolonged summer rains.

It should be noted that *Fusarium* sp., so destructive to cereal crops in many countries, are almost unknown in Belgium.

(b) *Roots.*

Potatoes. — This vegetable is attacked by ever-increasing varieties of enemies.

Blight (*Phytophthora infestans*) and the bacterial diseases which frequently follow it appear, so to speak, every year, but assume the proportions of a serious epidemic only about once in five years, when rains followed by heat prevail at the flowering period. The year, 1924, was marked by a heavy attack of blight.

The copper treatment is scarcely employed except in Lower Belgium, where the sea climate is particularly favourable to the de-development of the disease. Elsewhere it is considered sufficient to select varieties which are comparatively immune from attack, such as Industry, Roode, Star, etc.

The following cryptogamic diseases are also generally met with; bacterial scab is very prevalent especially in sandy, dry soils; powdery scab, (produced by *Spongospora subterranea*), on the contrary, is still very rare; black leg disease, especially in gardens too heavily manured or treated with sewage; winter rot (*Nectria Solani*) and various *Fusarium* sp. on in-growing wet tubers and those kept at too high a temperature; verticillium wilt (*Verticillium alboatrum*) especially in light soils and on certain varieties, such as the Eigenheimer; collar fungus (*Hypochnus Solani*), only slightly harmful as a rule.

Poisonous diseases, represented by the many forms of degeneracy (mosaic, curling, mottling, streaking, etc.) diminish production more than cryptogamic diseases, properly so called, and are especially menacing for the future.

This state of affairs calls for urgent attention and a campaign for the production of a regenerated plant. Several areas, especially Ardenne, up to the present still comparatively little affected, and possessing a climate but little favourable to the development of poison-carrying plant lice, would be suitable for experiments on potato selection.

Beets. — Unlike the potato, this plant is generally healthy in our country.

Beet and mangel rot (caused by various parasites · bacteria, *Pythium de Baryanum, Sphaerella tabifica*) is not frequent, peronospora (*Peronospora Schachtii*) is rare, heart rot (*Sphaerella tabifica*) is more frequent, especially with a dry summer.

With regard to the maculicular parasites on leaves, they are sometimes quite absent when the plants are taken up; some years, however, they are abundant, but, developing late, they do comparatively little harm. Of these, the following are given in the order in which they appear most frequently: *Pleospora putrefaciens, Cercospora beticola, Uromyces Betae, Ramularia Betae, Phyllosticta Betae.*

Cabbages, turnips, and mangels sometimes suffer more or less from finger-and-toe (*Plasmodiophora Brassicae*), black rot (*Pseudomonas campestris*) and mildew (*Erysiphe polygoni*).

(c) *Industrial plants.*

Hops. — Hops may be attacked by mildew (*Sphaerotheca humuli*) and by *Apiosporium* sp.

Flax. — With the exception of the scald caused by *Asterocystis radicis*, which is common in the endemic stage in Flanders, flax is almost immune.

Tobacco. — With the exception of mosaic, tobacco is rarely attacked by cryptogamic diseases.

(d) *Forage plants.*

Clover. — Has many enemies, among which the mildew disease (*Sclerotinia Trifoliorum*), which sometimes causes serious damage after mild and wet winters, and leaf-spot (*Gloeosporium, Caulivorum*), which came from America in 1901 and is extending, should be mentioned.

Peronospora (*Peronospora Trifoliorum*) and oidium (*Erysiphe polygoni*) are never abundant ; and cases of dodder (*Cuscuta minor*), are rare.

Market Garden Plants.

There are some important cryptogamic enemies to the cultivation of these plants, which are very prevalent in certain districts of the country, especially in the neighbourhood of large towns.

We will especially call attention, with regard to tomatoes, to mildew, against which copper spraying is resorted to, bacterial disease (*Phytobacter. Lycopersicum*) and leaf rust (*Cladosporium fulvum*) ; with regard to celery, leaf scorch (*Septoria Petroselini Apii*) ; with regard to beans, pod scab (*Colletotrichum lindemuthianum*) ; and with regard to the strawberry plant, to leaf blight (*Sphaerelle Fragariae*).

Fruit trees and Bushes.

The Apple tree. — Apple scab (*Venturia inaequalis*) often damages crops seriously, especially after a wet spring (the last fortnight in May is an especially critical period). Preventive treatment, for which Bordeaux mixture is used in preference to Californian, is scarcely yet in general use in the orchards.

Powdery mildews (*Podosphaera leucotricha*) are on the increase, especially in the case of certain varieties of apple. Canker (*Nectria galligena*) frequently renders unproductive certain varieties planted in compact and, especially in acid soils.

Brown fruit rot (*Sclerotinia fructigena*) does not attack the young shoots, but often rots the fruit on its approach to maturity or, later, during the first months of its storage.

Rotting of wood and trunk caused by polyporaceae is rare; on the other hand tree root rot caused by *Armillaria mellea* is rather frequent, and on pear-trees also, but this parasite does not generally attack stone fruit.

Pear-tree. — Pear scab (*Venturia pirina*) is the most serious enemy. Leaf mildew (*Mycosphaerella sentina*) is very frequent, but appearing late and only affecting the leaves, is much less harmful. Pear leaf cluster-cup (*Gymnosporangium sabinae*) is only found where its teleutospore host, the Sabine juniper, exists in its near neighbourhood.

Cherry-tree. — It suffers from the attacks of grey blight (*Sclerotinia cinerea*), the acid varieties of cherry being particularly subject, especially the Northern Cherry, the leafy shoots and flower of which are often killed in spring.

Plum-tree. — It is generally free of disease in the early stages of growth. Necrosis of the branches, caused by *Cytospora purpurescens*, is rather rare, as is also the stem disease caused by *Stereum purpureum*.

On the other hand, the old plants often perish progressively through the destruction of the wood of the branches and trunk by *Polyporus ignarius* var. *fulvus*.

Blister Disease (*Taphrina Pruni*), witch's broom (*Taphrina Insititiae*), leaf brown (*Phyllosticta prunicola*), blight (*Puccinia Pruni spinosae*) rarely do any serious harm.

Peach-tree. — Leaf blister (*Taphrina deformans*) is a serious enemy; oidium and gummosis leaf disease (*Coryneum Beyerincki*) do much less harm.

Apricot-tree. — The apricot-tree, which is little cultivated is generally immune from cryptogamic diseases.

Walnut-tree. — The fruits and leaves are often spotted with black from *Gnomonia leptostyla* and it sometimes perishes from the attacks of various polyporaceae.

Chestnut-tree. — But little cultivated, it is, contrary to what has been said, still exempt from the attacks of the dangerous canker parasite *Endothia parasitica.*

Vine. — Cultivated under glass over wide areas, especially in the neighbourhood of Brussels; serious enemies to the vine are powdery mildew (*Uncinula necator*), which is systematically treated by sulphuring, and grey mould (*Sclerotinia Fuckeliana*).

Grape mildew (*Plasmopara viticola*) does not develop in the hothouse, but is frequently observed in the open air on trellis vines.

Currant-tree. — The currant-tree, sometimes extensively cultivated, has greatly suffered since 1909 from the attacks of American gooseberry mildew (*Sphaerotheca mors-uvae*); it does not yet exist everywhere, certain districts, very limited indeed, such as the Namur region, being still immune. The potassium sulphide treatment gives excellent results everywhere.

Leaf spot (*Pseudo-peziza Ribis*) sometimes causes the premature fall of the leaf of currant-trees, and is then, consequently, very harmful.

Forest and ornamental trees.

Though the old populations, which are nearly all deciduous trees, well adapted to local conditions, scarcely suffer at all from cryptogamic parasites, such is not the case with those often planted under conditions which but imperfectly fulfil the requirements of plant-life, especially of many groups of exotic resinous species.

Thus the oak, with the exception of mildew (*Microsphaera Alni* var. *quercina*), which has been prevalent in nurseries and on the summer shoots of copses since 1907, has no very serious cryptogamic enemies; neither has the beech, nor the majority of the other native deciduous species. It should be noted that the elm has suffered since 1919, and especially in 1924, from the curious disease studied at Wageningen by Mlle. Spierenburg, a true sclerosis, of which the causes are still quite unknown.

On the other hand, the Scots pine (*Pinus sylvestris*) has many enemies. Among these, pine leaf cast (*Lophodermium Pinastri*), especially disastrous in nurseries, attacks it in the earliest stages;

later pine branch twist (*Melampsora pinitorqua*), root rot (*Armillaria mellea*) and conifer root rot (*Fomes annosus*), are among the more important. It should be noted that *Trametes Pini* which ravages the old clumps of Scots pines in the Baltic plain and the mountains of Central Europe, has not yet been observed in Belgium.

The Weymouth pine is gradually disappearing under the attack of the disastrous pine rust (*Cronartium ribicolum*), in the absence even, it appears, of its teleutosporian host, the currant-tree.

The spruce suffers less than pines ; needle blight (*Chrysomixa Abietis*), needle disease (*Lophodermium macrosporum*), leaf blotch (*Ascochyta piniperda*) seldom do much damage. Very few species of firs are grown. The future of the larch seems to be irremediably compromised by the attacks of canker (*Dasyscypha Wilkommii*) which is much more virulent in our country than in its native mountains.

(2) PHYTOPATHOLOGICAL ORGANISATION.

(a) *Research Institutions.*

State Phytopathological Station at Gembloux.

This institution was founded in 1894 in the Plant Biological Laboratory of the late Prof. Emil LAURENT, who requested me to study the cases of cryptogamic diseases which he observed or which were submitted to him by cultivators.

A very modest Phytopathological Service was thus created, and it was officially recognised in 1900 and raised to the status of a Research Station in 1912, within the limits of an Agronomic Station, and under the name of the " State Phytopathological Station ".

Nevertheless this elevation to an administrative hierarchy, though followed by improvement in the material equipment of the laboratory, was not attended by any development of the working capacity of the institution, the budget remaining at a ridiculously low figure and its scientific staff reduced to a minimum.

Let us briefly examine the proofs of activity of which the Phytopathological Station at Gembloux has, in spite of these drawbacks, been the seat.

Information Department. — In spite of its being absolutely gratuitous, those interested rarely avail themselves to any great extent of this Service. The maximum number of written consultations (292) was registered in 1913 ; the yearly average is not above 150.

It should be noted that inquiries are mostly received from private horticulturists who desire information respecting the enemies of their fruit-trees and vegetables.

Laboratory Research and Practical Tests. — Apart from an annual report giving the principal phytopathological observations and the results of practical tests, which for pecuniary reasons, ceased to appear after 1920, I have published since 1894 the following works on theoretical and applied Mycology :

1894. — Sur quelques champignons nouveaux du Congo. (*Bull. Soc. belge de Microscopie,* Vol. XX, p. 259).

1901. — Recherches biologiques sur une Chytridinée parasite du Lin. (*Bull. de l'Agriculture,* 46 pp.).

1901. — Influence des sels minéraux nutritifs sur la production des nodosités chez le Pois. (*C. R. de l'Acad. des Sciences de Paris,* Vol. CXXXIII, p. 1032).

1902. — De l'immunisation de la Laitue contre le " Meynier ". (*Idem,* t. CXXXV, p. 1067).

1902. — De la spécialisation du parasitisme chez l'*Erysiphe graminis*. (*Idem,* Vol. CXXXIV, p. 210).

1902. — Contribution à l'étude du champignon du caryopse des Lolium. (*Bull. de la Soc. de Bot. de Belgique,* Vol. XLI, p. 61).

1903. — De la spécialisation du parasitisme chez l'*Erysyphe graminis,* 2nd note. (*C. R. de l'Acad. des Sciences de Paris,* Vol. CXXXIV, p. 1068).

1903. — Recherches sur la rouille des Céréales. (*Bull. de l'Agriculture,* 40 pp.).

1908. — Une maladie nouvelle du Poirier. (*Bull. de la Soc. Royale de Botan. de Belgique,* Vol. XLV, p. 343).

1909. — De l'apparition, en Belgique, du *Sphaerotheca Mors-Uvae*. (*Idem,* Vol. XLVI, p. 337).

1921. — Contribution à l'étude des champignons fructicoles de Belgique. (*Idem.* Vol. LIV, p. 109). En collaboration avec E. Marchal.

1922). — Champignons parasites nouveaux pour la flore belge récoltés en 1915-1918. (*Idem,* Vol. LV, p. 47). En collaboration avec F. Sternon.

1923. — De l'homothallisme de quelques Ascomycètes. (*Bull.*

de la Classe des Sc. de l'Acad. Royale de Belgique, n° 1, janvier). En collaboration avec E. MARCHAL.

1924). — Sur les rapports existant entre des formes conidiennes du type *Ramularia* et le genre *Entyloma*. (*Bull. de la Soc. Royale de Bot. de Belgique*, Vol. LVII, p. 51). En collaboration avec M. F. STERNON.

1924. — De la prétendue existence, en Belgique, de l'*Endothia parasitica* du Châtaignier. (*Congrès de l'Ass. franç. pour l'Avancement des Sciences, Liège*).

1924. — De l'emploi du carbonate de cuivre pour la désinfection du grain dans la lutte contre la carie. (*Idem*).

Other institutions for research.

The Agricultural Institute of the Catholic University at Louvain has a Chair of Applied Cryptogamy, the holder of which, Canon BIOURGE, is carrying on valuable work in Microbiology, but no special research work is carried on at the University in Phytopathology.

The instruction given at the Flemish Agricultural Institute, founded at Ghent in 1920, also includes a course of Botanical Pathology, under M. VAN HOVE, Chief of the Phytopathological Inspection Department, for which a laboratory for research work has recently been equipped. At the Horticultural School at Vilvorde a laboratory for the study of horticultural plant diseases has also recently been organised, under the direction of Professor SEGHERS. These institutions, which are still in their infancy, have not yet achieved any important work.

It should be noted that the State Botanical Gardens at Brussels have had on their staff mycologists who have treated various problems in Plant Pathology, of whom the late Custodian P. NYPELS is deserving of special mention.

b) *Phytopathological Legislation and Phytopathological Inspection Department.*

Previous to 1912, Belgian legislation for the protection of plants was almost non-existent, there being laws only for the destruction of thistles and caterpillars.

The law of 27 June 1912 made it possible to adopt severe measures for preventing the introduction into the country of insects or other animals, and cryptogams or other plants harmful to crops.

Thanks to these new provisions, and under pressure of the restrictive measures adopted by the United States against the importation of Belgian horticultural products, a Phytopathological Inspection Department was organised.

Finally, decisions have recently been taken with a view to controlling the woolly aphis (*Schizoneura lanigera*) and the American mildew on the currant-tree (*Sphaerotheca Mors-Uvae*), and for regulating the importation of potatoes in order to prevent the country being invaded by the *Doryphora decemlineata* and *Synchytrium endobioticum.*

The Phytopathological Inspection Department known in Belgium as the " Special Phytopathological Department " undertakes to inspect : (*a*) the horticultural establishments, properly so-called, every six months ; (*b*) the horticultural and agricultural products intended for exportation, for which a phytopathological certificate must be obtained ; (*c*) the horticultural and agricultural products which it is proposed to import without certificates.

The staff of this Department at present includes : an Inspector, Chief of the Department ; an Assistant-Inspector ; an expert ; five assistant-experts ; eight Members of the State Council of Horticulture are also attached to the Department as assistant-experts.

CONCLUSIONS.

A general survey of the phytopathological problem in Belgium leads to the following conclusions :

The sanitary state of crops is, on the whole, comparatively satisfactory and really disastrous cases of disease are rare.

The phytopathological factor should nevertheless be taken into very serious consideration especially at the present time, when there is urgent need to intensify in every possible way all forms of crop production.

In order to reduce the very considerable losses caused by the phytopathological factor, it is necessary :

(1) to develop the working equipment of the Phytopathological Research Institutions in order to enable them to study the diseases which attack crops and to determine the local conditions under which

the evolution of the parasites takes place, which is indispensable for establishing a scientific scheme of control;

(2) to insure a close collaboration of these phytopathological research stations with the Meteorological Departments and Research Station for the Improvement of Cultivated Plants, in order, on the one hand, to determine the relations existing between the course taken by diseases and meteorological conditions, and on the other hand, to endeavour to produce varieties which offer resistance to the principal diseases;

(3) to complete and revise the legislation on the supervision of plant hygiene and to develop the Phytopathological Inspection Department so as to extend its competence and action to all forms of plant production;

(4) to organise an active campaign for diffusing a knowledge of plant diseases and the means of controlling them in a practical way.

EM. MARCHAL,

Director of the State Phytopathological Station, Gembloux.

INTERNATIONAL ASSOCIATIONS

PROCEEDINGS OF THE INTERNATIONAL SOCIETY OF SOIL SCIENCE.

Papers.

APPARATUS FOR SOIL VOLUME DETERMINATION.

With the object of obtaining the most accurate results possible in volume and pore space determination, especially as regards soil types under natural conditions, FROSTERUS (1) constructed an apparatus in which the volume of the sample is displaced by mercury. With this apparatus accurate results could be obtained, but the determination process involved loss of time through weighing, especially in the case of small samples. As the apparatus was made in Helsingfors during the War, it left something to be desired in the matter of material and finish. With the object of improving the original apparatus, FRAUENFELDER attempted to simplify it, so that the displaced volume could if possible be measured without weighing, and long calculations be thus avoided.

The apparatus shown below is the result of the proposed alterations.

Description of the apparatus. - The apparatus consists of three principal parts (Plate XXIII, fig. 55):

1) *The volume determination cylinder.* — This consists of an upper cover and a lower part (B). The top part is fastened by means of three lever clamps to the foot, so that the marks on either part pass one over the other. The pointed apex of the cover passes up into a tube, at the end of which there is a tap *b*. In front of this outlet in the cover a glass tripod is attach-

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(1) BENJ FROSTERUS, *Geol. Komm. in Finland: Agrogeologischkarter*, Vol. 2, Pt. 22, 1916, 168) I. 1.

PLATE XXIII.

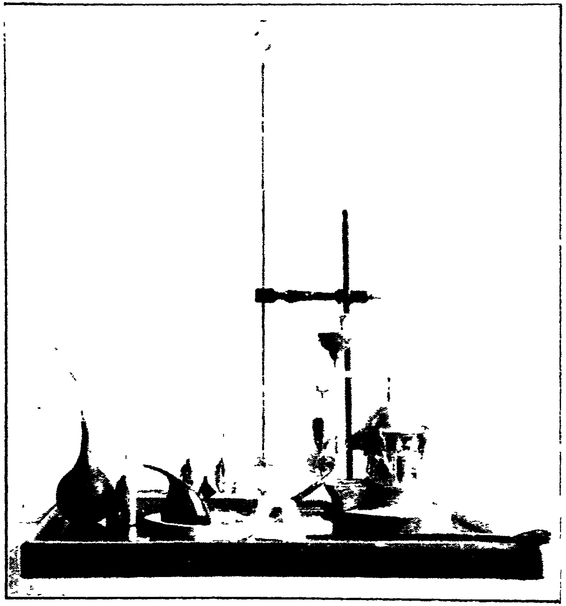

FIG 55 — Frosterus and Fraunfelder's apparatus for soil volume measurement

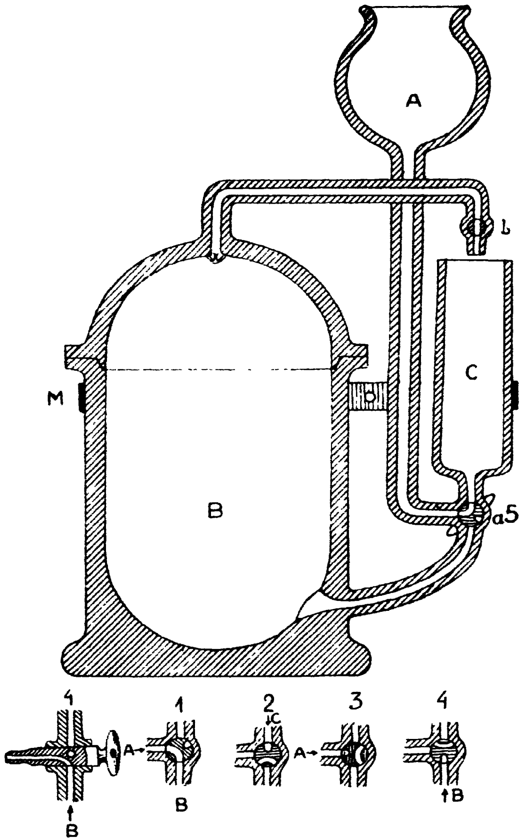

FIG 56 — Complete apparatus with pycnometers and burette

ed to prevent the sample from coming into contact with the outlet. From the lower part B a tube issues as far as tap *a*, where the filling funnel A and the continuation of the cylinder C, which lies under tap *b*, branch off.

The inner diameter of B is 50 mm. and its height 100 mm., so that samples up to 100 cc. can be determined.

In order to avoid the breaking of parts A and C, these are attached to the lower part B with the metal band M, to which the lever clamps are also fastened.

2) *Pycnometers.*

3) *Burette.*

In addition to the pycnometers and burette the apparatus includes a mercury pressure-guage.

Manipulation of the apparatus. -- The mercury enters the cylinder from below, whereby the bubbles adhering to the glass are expelled.

The filling is done in the following manner:

The tap *a* is turned off against B (position 2), and the funnel A, filled with mercury and *a*, are brought slowly into position 5. *a* and C are thus placed in communication and the air under the mercury in A is driven out. Now tap *b* must be opened and the space B can, in *position* 1, be filled through A until the excess runs through *b* towards C.; *b* is then closed. The excess in C is then allowed to run out, *position* 2. Tap *a* is lengthened by a piece of tubing about 12 cm. long, so that the mercury may be allowed to flow easily and without loss into a vessel; the mercury in A is likewise expelled by *position* 3. The apparatus is now ready for use. The collecting vessel with the excess mercury is removed and another put in its place. Tap *b* is opened and *a* brought into *position* 4, so that sufficient mercury may be allowed to flow out of B to leave the cover free. The three springs pressing tightly on the cover are then loosened and the latter is removed. The sample, of which the volume is to be determined, having been weighed, is placed on the mercury, the cover is closed, and the filling begins as before (the air being expelled by *position* 5) in the positions 1, 2 and 3. The overflow now collected corresponds to the volume.

In order to determine this volume as exactly as possible, *pycnometers* were found to be most suitable. A series of 6, of 50, 25, 20, 15, 10 and 5 cc. were used. Volumes below 5 cc. were measured in a burette of 5 cc. cubic content by 50 cm. in length, so that $^1/_{100}$ cc.

can be determined very accurately. The upper part of the burette expands in the form of a bulb.

The filling of the pycnometers is best done in a small flat evaporator with a vent. There is also a brush and rubber ball for blowing out the mercury remaining in the taps and tubes. The apparatus is emptied by first opening tap *b* and then bringing tap *a* into *position* 4; this position is shown in fig. 56, to the left, in the longitudinal section.

After the removal of the sample, dust, sand, soil and other impurities are often found to be floating on the mercury. These may be removed with a piece of wadding.

If samples soaked with paraffin are tested, the apparatus must be cleaned more often.

Accuracy of the apparatus. — The results are given under the following formulae:

Weight of the sample	w in grams
Volume	v in cc.
Volume-weight	*w*
Specific weight	s
Pore space (in %)	$\frac{(s - \frac{w}{v})\,100}{s}$

The specific weight of porous substances (checks) is determined, as usual, with the pycnometers.

In order to test the accuracy of the apparatus a number of samples were repeatedly determined.

A red quartzite on which 10 determinations were made on different days, always gave the same results:

Weight of the sample	37.120 gm.
Volume	14.600 cc.
Volume weight	2.54

The greatest errors occurred with porous, non-paraffin substances. For instance, a quarternary clay brick, gave 3 determinations out of 10 which showed 0.015 cc. in excess of the others.

Weight of the brick	49.770 gm.
Vol.$_1$ (7 readings)	25.650 cc.
Vol.$_2$ (3 »)	25.665 »
The volume-weight$_1$ is therefore	1.940
and the volume-weight$_2$	1.939
The specific weight was	2.55

$$\text{Pore space}_1 \frac{(2.55 - 1.94)\,100}{2.55} = 23.92\ \%$$

$$\text{Pore space}_2 \frac{(2.55 - 1.93)\,100}{2.55} = 23.96\ \%$$

The difference is therefore 0.04 %, in the most unfavourable conditions, i. e. when the volume weight of 1.939 is not raised to 1.94.

This, so far the greatest difference shown, naturally arose only from the fact that the porous check was non paraffin, and for this reason mercury penetrated it and escaped measurement.

The application of the apparatus. — The apparatus is adapted for testing · Soils, minerals, various kinds of stone, potter's clay, artificial stones (beton or concrete), etc.

A number of examples are given below

Pore space	Specific weight	Volume weight	SAMPLES	
			Soil types.	
57.5	2.66	1.13	Gystje type Postglacial clay, Odnaes, Pojo.	
43.1	2.69	1.53	Postglacial clay, Aemmne - Hahkke	
39.8	2.61	1.57	Glacial band clay Vestankvarn	
40.2	2.73	1.63	» » » Pargas	
39.1	2.73	1.66	Mo, Odnaes - Pojo	
37.2	2.71	1.70	Light mjaela clay, Mustiala	
31.9	2.72	1.85	Light mjaela clay, Kelivaara	
28.3	2.68	1.92	Cambridge clay, Kivimiemi	
29.2	2.77	1.96	Cambridge clay, Kiviniemi	
			Soil section.	
67.8	2.27	0.73	Mo rich in humus A - bed	Karis.
53.3	2.57	1.20	» » B - bed	
22.9	2.71	2.09	Marshland, marl (bituminous soil) upper bed	Zurich.
25.8	2.67	1.98	middle bed	
29.0	2.68	1.90	Marl under bituminous soil (subsoil)	-

Pose space	Specific weight	Volume weight	SAMPLES
			Minerals and Stones.
		1.24	Anthracite.
		1.88	Schungite (Schunga) - Olonetz.
		1.92	Graphite Schungite from Suojaervi - Finland.
		2.09	Graphite (earth) from Krumau - Bohemia.
		2.46	» (crystal) » Maentyharju - Finland.
	2.65	2.65	= Quartz.
	2.60	2.60	= »
	2.44	2.44	= Tridinite (somewhat impure, graphitic.)
	2.42	2.42	= Chrystobalite (somewhat impure, graphitic).
	2.19	2.20	Quartzglass.
		2.55	Feldspar from Kimito - Finland.
		3.15	Tourmaline from Tyrvea »
		4.10	Gadolinite from Kimito »
		2.57	Rapakivi granite from Aeland - Saltvik.
		2.68	» » Mariehamn.
		2.65	» » Kotka.
		2.64	» » Simola
		2.69	Granite from Kalajoki.
		2.66	» » Iisalmi
		2.65	» » Nystad
		2.79	Diorite » Kaalamo
		2.99	Diabase » Lavia.
		2.88	Gabbro » Kyvinkaeae.
		3.40	Amphibolite » Leppaevirta.
			Brick earth products.
36.8	2.96	1.87	Cambridge clay heated to 900° C.
24.0	2.66	2.02	» » » » 1000° »
12.5	2.55	2.33	» » » » 1100° »
9.3	2.57	2.33	» » » » 1150° »
30.1	2.65	1.85	» » clinkers
11.2	2.58	2.30	» » »
23.9	2.55	1.94	Builders' bricks, postglacial clay (Aminne) heated to 900° C.
21.3	2.62	2.06	Quartz-clay bricks from Sweden
25.4	2.44	1.82	Quartz-lime bricks from Sweden.
28.5	2.56	1.83	" Stella " bricks.
22.4	2.41	1.87	Quartz-limestone 10 from Germany.
20.0	2.39	1.91	» 12 »
26.1	2.49	1.85	» 22 » Finland
40.2	2.69	1.57	» 30 » »

B. FROSTERUS and H. FRAUENFELDER.

HYDROGEN-PEROXIDE CATALASE OF MARSH SOILS.

The influence of the soil as a positive catalytic agent in the combination of hydrogen with oxygen at an ordinary temperature was already known by THEO. DE SAUSSURE (1), LIEBIG and H. IMMENDORF. The last named ascribed this interesting property to the microorganisms of the soil. A. J. NABOKISCH, LEBEDEFF (3), KASERER and others further investigated this question.

The converse phenomenon, that the soil liberated molecular oxygen from hydrogen-peroxide was known to BERZELIUS (4), FRASS and SCHOENBEIN (5), and in recent times was investigated by J. KOENIG (6), C. KOPPENRATH, HASEN-BAEUMER and PAPA KALANTARIAN (7). In this respect the soil resembles certain catalytic agents, such as the fine dust (of almost colloidal fineness) of some metals: gold, silver, platinum; many oxides (8), manganese dioxide, manganese tetroxide, ferric-oxide, super-oxides, sesquioxides, the ultra-violet rays and some enzymes (9).

KOENIG considers the hydrogen-peroxide catalase of the soil (he finds it absent after liberating molecular oxygen from H_2O_2) to be a very important property (10) of the soil, and ascribes it in the first place to the enzymes in the micro-organisms and vegetable matter, for he found that this property of the soil diminished after partial sterilisation by heating, chloroform (11) or carbon disulphide. Like COPPENRATH and HASENBEAUMER, he explains this by its close connection with the humus content. MAY and GILLE held the same opinion (13). Many investigators consider it of very great importance in estimating the properties of the soil (14), others, for instance D. CHOUCHATK (15), measure the biological index by it. KOENIG gives numerous instances of catalytic action before and after soil sterilisation, and from his discoveries it is evident that inorganic matter also plays an important part and that it is a question not only of soil catalytic action (16) by bacteria or the residues of organic matter. This is found to be the case also as regards marsh soils.

In spite of the fact that the origin of this soil catalase cannot be attributed strictly to the characteristic properties of the soil only, it will not be without interest from a purely soil science point of view, to compare the catalytic capacity of some marsh soils and endeavour to ascertain some relations, or at least tendencies among them. It will be shown how in a large number of soil types the hydrogen-peroxide catalase in vertical sections alters, and how it is changed by drying the soil at different temperatures. Types of different texture and, where possible, from different climates will be considered. An attempt will be made to find a connection between this soil catalase and the physical structure, hygroscopicity and constant and variable soil reaction.

The degree of soil catalase was measured eudiometrically. As the decomposition of the hydrogen peroxide of most of the catalases also depends on the H_2O_2 concentration and the reaction temperature, the working conditions were in every case identical and constant. Five gms. of fine earth were treated, 20 cc. of H_2O_2 were added and the temperature kept at exactly 17° C. The first determinations of liberated oxygen were made without reduction of atmospheric pressure, the second were ascertained after such reduction (the second result is therefore much smaller than the first).

Types were examined, the majority of which in the ZEMEDELSKY Archives (17) showed that they were related in physical composition. Here, for the sake of brevity, their physical composition will not be discussed, but only their pedological classification (according to KOPECKY), and for a more complete soil determination is added the hygroscopicity according to RODEWALD-KITSCHNERLICH (18) and the calcium carbonate content estimated approximately with the Kreidl volumetric apparatus.

As may be seen from Table I, the soil substance varies very much in composition.

The oxygen set free by the treatment of air-dried soils (under conditions given above) is shown in Table II, column *a*.

(TABLE I, *see page 107*).

TABLE I.

Origin	Depth in cm.	Soil type	Hygroscopicity	$Ca\,CO_3$	pH reaction	
					constant	variable
		I. — AGRICULTURAL SOILS.				
1. **Hulin**	10–20	humous loam — dark brown	5.28	0.1	7.3	7.0
»	30–40	" " " "	5.98	0	7.1	7.0
»	60–70	" " " "	5.75	0	7.1	7.0
»	90–100	" " " "	6.25	0	7.0	7.0
»	120–130	Yellow Loess loam	3.19	0	7.3	7.0
»	300–310	" " "	—	9.64	7.3	7.2
2. **Břest-Hulín**	10–20	sandy loam — brown	4.40	0.3	7.3	7.2
»	20–30	" " — dark brown	4.49	0.4	7.3	7.2
»	40–50	slightly clayish sand — yellow	1.63	0	—	7.2
3. **Slapanice 84**	20–30	clay loam — brown	6.87	0	7.2	7.0
»	40–50	clay loamy soil — brown	7.74	0.1	7.2	7.2
»	60–70	yellow loess loam	5.45	19.6	7.2	7.2
»	120–130	" " "	5.07	17.0	7.2	7.3
»	140–150	" " "	—	32.7	7.2	7.3
4. **Slapanice 85**	10–20	clay loam — brown	7.08	0.2	—	—
»	40–50	clay loamy soil — brown	8,18	0	—	—
»	80–90	yellow loess loam	6.77	0.2	—	—
»	130–140	" " "	—	12.0	—	—
5. **Ivanovice**	10–30	humous clay loam — dark brown	6,18	0	7.2	7.2
»	44–60	clay loam — yellow	6.56	0.5	7.2	7.2
»	60–75	loam — yellow	5.22	10	7.3	7.3
»	80–90	" "	4.88	14.7	7.3	7.3
6. **Hrušovany-Sanov**	20–30	humous, sandy, clay loam — black	8.58	0.3	7.3	7.2
»	90–100	clay loam — greenish	11.62	19.4	7.2	7.2
Hrabitice	10–20	loamy sand — brown	2.38	0.1	7.1	7.0
7. **Hustopeč**	5–15	loam — brown	5.53	11.6	7.3	7.3
«	20–30	" — grey	6.08	6.5	7.3	7.3
»	35–45	" "	4.94	26.9	7.3	7.2
»	80–90	fine sandy loam — yellow	3.89	18.4	7.2	7.3
8. **Olomouc**	20–30	sandy loam — brownish — yellow	3.06	0	7.1	7.0
»	50–60	loamy sand	1.10	0	7.0	6.5
» **Upper Ortstein**	60–65	slightly clayish sand — reddish.	1.65	0	6.5	6.5

TABLE I (*continued*).

Origin	Dept in cm.	Soil type	Hygroscopicity	Ca CO_3	pH reaction	
					constant	variable
8. Olomouc Lower Ortstein	75–80	slightly clayish sand — strong reddish	1.86	0	6.3	6.5
9. Hodonin	10–20	slightly clayish sand — dark brown	1.01	0	7.1	7.0
»	35–45	slightly clayish sand — brown.	0.61	0	7.1	7.0
»	80–90	slightly clayish sand — yellow.	0.48	0	7.0	7.0
»	250	clay loam — greenish	6.69	3.2	7.2	7.1
10. Hrušovany	10–20	clay sand — black	3.91	0.3	7.3	7.2
»	30–40	clay loamy sand — brown	5.73	0	7.2	7.1
»	60–80	clay loamy sand — brown-yellow	5.24	0	7.1	7.0
»	150–160	clay loamy sand — yellow	1.62	6.1	7.3	7.2
11. Poštorná	10–20	sandy loam — brown	3.06	0	7.1	7.0
»	30–40	" " "	3.94	0	7.1	7.0
»	60–70	loamy sand — yellow-brown	2.88	0	7.1	7.0
»	150–160	slightly clayish sand — yellow	1.50	0	7.3	7.0
12. Val Mezerici	10–20	slightly humous clay loamy sand — yellow	3.14	0	6.4	6.4
»	30–40	sandy loam — yellow	2.61	0	6.5	6.3
»	60–70	yellow loam	5.95	0	6.5	6.3
»	120–130	loam – yellow	5.85	0	6.4	4.9
13. Radomin	8–13	" "	3.81	0	7.1	6.4
»	30–40	" "	4.26	0	6.4	4.6
»	80–90	loamy sand — yellow	4.51	0	6.4	4.4
14. Tichà	5–15	loam — grey	5.07	0	6.6	6.4
»	20–30	loam — yellowish	5.43	0	6.6	6.3
»	70–80	fine sandy loam – – yellow	9.67	0	6.3	4.4
»	150–160	clay loamy soil — yellow	8.55	0	6.3	4.4
		II. — FOREST SOILS.				
15. Adamov	0–3	forest litter	10.72	0	5.9	5.4
»	3–17	clay loam soil — light yellowish	4.28	0	6.3	4.5
»	17–34	" " " — nearly white	3.67	0	6.9	6.1
»	34–49	" " " — yellow	6.01	0	7.1	6.3
»	49–74	" " " — bright reddish	8.10	0	7.1	6.3

TABLE II.

Origin	Depth in cm.	a Air-dried soil		b dried at 55° C.		c dried at 100° C.		d boiled in water for 1 minute	
		Time in Min.	O_2 in cc.	Time in Min.	O_2 in cc.	Time in Min.	O_2 in cc.	Time in Min.	O_2 in cc.
I. — AGRICULTURAL SOILS.									
1. Hulin	10–20	10	57.2	5 10	38 58,2	5 10	27.2 43.4	5 10	29.6 50.5
»	30–40	10	52.4	5 10	33.5 56.6	5 10	27 42.6	5 10	27 49.2
»	60–70	10	36.4	5 10	24 39	5 10	19.8 31.3	5 10	20.7 36.4
»	90–100	10	20	5 10	14.4 22	5 10	12.2 18	5 10	9.2 16.3
»	120–130	10	25.6	5 10	18.8 28.5	5 10	15 23.8	5 10	8.6 18.8
»	300–310	6′50″	80	5	80	5 5′40″	73.2 80	5 5′4″	75 85
2. Brešt-Hulin.	10–20	5 10	26.4 40	5 10	24 39	5 10	22 35.6	5 10	19.8 34.3
»	20–30	5 10	28.2 41.8	5 10	25.2 39.6	5 10	21.0 35.4	5 10	16 31.7
»	40–50	5 6	70 80	5 6′33″	63.6 80	5 7′6″	60.4 80	5 7′45″	56 85
3. Slapanice 84	20–30	5 5′55″	72.3 80	5 6′4″	71 80	5 6′17″	69.8 80	5 7′40″	60.8 85
»	40–50	5 6	68.6 80	5 5′5″	79.6 80	5 5′22″	75.4 80	5 5′25″	79 85
»	60–70	5 10	46 79.2	5 8′25″	51.4 80	5 8′45″	50.8 80	5 8′8″	54 85
»	120–130	5 7′55″	61 80	5 7′15″	61.8 80	5 7′22″	61.2 80	5 8′23″	52.8 85
»	140–150	5 10	22 35	5 10	23.4 38.4	5 10	20.4 34.6	— —	— —
4. Slapanice 85	10–20	4′10″	80	2′53″	80	3′53″	80	5′ 5′6″	84 85
»	40–50	5 9′10″	53.8 80	5 8′47″	53 80	5 10	45.2 76.4	5 10	43.2 76.2
»	80–90	5 10	43 68.2	5 10	40 69.8	5 10	39.8 68.3	5 10	33.2 61.2
»	130–140	5 10	48.6 77	5 9″35″	18.4 80	5 10	45.5 78.4	5 10	35.4 65.6
5. Ivanovice	10–30	5 7′12″	63.4 80	5 7′26″	60.2 80	5 8′19″	56 80	5 10	35.2 74
»	44–60	5 9	55.2 30	5 8′58″	53 80	5 9′35″	50 80	5 10	37.8 71
»	60–75	5 10	46.4 79	5 9′13″	51.6 80	5 8′50″	51.6 80	5 10	46.6 81.8

TABLE II (*continued*).

Origin	Depth in cm.	*a* Air-dried soil		*b* dried at 50° C.		*c* dried at 100° C.		*d* boiled in water for 1 minute	
		Time in Min.	O_2 in cc.	Time in Min	O_2 in cc.	Time in Min.	O_2 in cc.	Time in Min.	O_2 in cc.
5. **Ivanovice**	80–	5 10	47.2 75	5 9′28″	48.6 80	5 9′25″	49 80	5 10	35.4 69
6. **Hrušovany-Sanov** . .	20–30	5 7′50″	66 80	5 5,12″	78.3 80	5 7	67.6 80	5 7′13″	66.8 85
» . .	90–100	5 10	15.4 23.6	5 10	13 22·8	5 10	13.6 22.4	5 10	4.6 11.4
Hrabetice	10–20	5 10	23.4 31.8	5 10	21.4 30.3	5 10	17.2 23.2	5 10	12 20
7. **Hustopeč**	5–15	5 5′5″	79 80	4′15″ —	— 80	5 5′30″	75.4 80	5 8′58″	75 85
»	20–30	3′50″	80	3′23″	80	5 5′3″	73.6 80	5 5′15″	82 85
»	35–45	5 10	47.6 72	5 10	46 74.8	5 10	41.2 68.8	5 10	33 63.6
»	80–90	5 10	43.6 71.5	5 10	47 78.2	5 10	43.4 73.6	5 10	31 59.2
8. **Olomouc**	20–30	5 10	17.8 23.8	5 10	12.5 17.7	5 10	6.6 11	5 10	6.6 11
»	50–60	5 10	6.6 7.0	5 10	4 3.8	5 10	2.4 1.8	5 10	0.4 1
» **Upper Ortstein**	60–65	5 7′30″	59.8 80	5 7′10″	62 80	5 8′2″	56 80	— —	— —
» **Lower Ortstein**.	75–80	5 10	11.6 14.7	5 10	7.2 7.8	5 10	7.6 10	5 10	2.4 3.9
9. **Hodonin**	10–20	5 10	10 12	5 10	7.8 9.8	5 10	4.8 6.4	5 10	4.7 7
»	35–45	5 10	4.8 4.3	5 10	3 2.6	5 10	2.2 1	5 10	0.4 0
»	80–90	5 10	4.6 3.4	5 10	2.2 1	5 10	1.4 0.2	5 10	1.4 0.5
»	250–	5 10	32.5 54.8	5 10	30.2 54.8	5 10	34.4 57.8	5 10	18.8 39
10. **Hrušovany**	10–20	5 10	36.8 50.8	5 10	34.6 50	5 10	30.8 44	5 10	26 39
»	30–40	5 6′30″	67 80	5 6′22″	66.8 80	5 6′45″	62.6 80	5 10	27 54.5
»	70–80	5 9	54.4 80	5 8′22″	54 80	5 7′59″	56 80	5 10	40 72
»	150–160	5 10	42.8 68.2	5 10	46.8 75.6	5 9′20″	51 80	5 10	36 63.2
11. **Postorná**	10–20	5 10	21.2 30	5 10	19.5 28.6	5 10	17.2 25	5 10	12.2 20.0
»	30–40	5 10	20.4 29.2	5 10	16.7 25.2	5 10	16.3 26.2	5 10	8.7 17.2

TABLE II (*continued*).

Grigin	Depth in cm.	*a* Air-dried soil		*b* dried at 50° C.		*c* dried at 100° C.		*d* boiled in water for 1 minute	
		Time in Min.	O_2 in cc.	Time in Min.	O_2 in cc.	Time in Min.	O_2 in cc.	Time in Min.	O_2 in cc.
11. **Postornà**	60–70	5 10	12.2 16	5 10	8.8 12.3	5 10	6.2 9.6	5 10	3.7 7.8
»	250–260	5 10	10.4 12.4	5 10	7.3 8.3	5 10	7.2 8.8	5 10	1 2.2
12. **Val Mezérici**	10–20	5 10	28.6 38.8	5 10	22.2 32.6	5 10	18 26.6	5 10	18.7 29.2
»	30–40	5 10	36.8 50.8	5 10	30.2 43.4	5 10	25.4 36.9	5 10	24 38.8
»	60–70	5 10	33.0 46.8	5 10	32.4 46.8	5 10	23.8 42	5 10	22.3 37
»	120–130	5 10	14 20	5 10	10.8 16.7	5 10	14.1 20.5	5 10	6 12.4
13. **Radomin**	8–13	5 10	37 52.2	5 10	34.2 51.8	5 10	26 37.8	5 10	33 49.4
»	30–40	5 10	2.5 2.2	5 10	3 2.6	5 10	1.2 0.4	5 10	0.8 —
»	80–90	5 10	2.2 1.0	5 10	2.2 1.2	5 10	— —	5 10	2.8 1.8
14. **Tichà**	5–15	5 10	44.6 69.8	5 10	43.6 65.6	5 10	35.2 53.3	5 10	31 53.6
»	20–30	5 10	25 36.2	5 10	20.8 32.5	5 10	18.6 28.7	5 10	15.2 28
»	70–80	— 5	— 80	5 5′21″	76.4 80	5 6′35″	66 80	5 11″ 8′	56 85
»	150–160	5 10	22.3 33.6	5 10	22.8 36	5 10	18.5 27.3	5 10	6.4 14.5
II. — FOREST SOILS.									
15. **Adamov**	0–3	5 10	52.4 78.3	5 10	47.4 74.6	5 10	20.4 34.4	5 10	35.6 53
»	3–17	5 10	13.4 17.6	5 10	9 12.8	5 10	4.8 7	5 10	1 3
»	17–34	5 10	20.4 30.2	5 10	16.2 27	5 10	13.6 22	5 10	4 8.6
»	34–49	5 10	47.8 71.6	5 10	44 70.4	5 10	38 60.6	5 10	34 60
»	49–74	5 10	47.4 72.2	5 10	48 72.8	5 10	38.2 59.6	5 10	34.2 58.2

The soils cannot be compared by the speed constant of FAITELOWITZ (19) because no suitable H_2O_2 concentration was found for the soil, in which there was molecular reaction (determined in milk and blood. High concentrations render the catalase inactive in both). For this reason the soils are compared according to the number of cc. of oxygen set free in equal time.

Between the quantity of the liberated oxygen and the hygroscopicity of the different soils there was no marked connection (20). In Brest-Hulín, for instance, the least hygroscopicity was found in the lowest layers, but they set free the greatest quantity of oxygen. At Tichà, the hygroscopicity, owing to the clay soil and iron, increases with the depth, the catalase also reached its maximum at a depth of 70 to 80 cm., on the other hand the upper layers come after the soil vegetable matter as regards catalase. In the Adamover forest zone the minimum hygroscopicity is at a depth of 17-34 cm. and increases regularly on either side, the maximum being at a lower level. The minimum catalase is in the leached layer below the forest litter. The dynamic force of the soil constituents appears to be in relation with the catalase.

The iron and varying lime content in this Adamov type is given in Table III.

TABLE III.

Origin	Depth in cm	Fe_2O_3 %	Liberated O_2 in cc. in 10′	mg CaO in 100 gm Soil	pH reaction	
					variable	constant
Adamov	0–3	1.947	78	176	5.4	5.9
» .	3–17	1.608	17	38	4.5	6.3
»	17–34	2.114	30	82	6.1	6.9
» .	34–49	2.110	71	168	6.3	7.1
» .	49–74	3.362	72	200	6.3	7.1

As may be seen from Table III, the lime and iron content, the hygroscopicity and the variable and constant reactions are related to the catalytic force (lime was not found in the soil in the form of carbonate).

It is interesting to observe how the upper bed rock layer in the Olomouc section, becoming softer, differs from the lower. The upper layer is strongly catalytic whereas the lower is only slightly catalytic. As regards hygroscopicity there is only a comparatively slight difference.

No close relation was found between the calcium carbonate and catalase. In Hulin, for instance, the greatest catalytic power is found at a depth of from 300-310 cm., and here also the greatest quantity of lime was found. In Slapanice No. 85 the greatest lime content is at a depth of from 130-140 cm., the catalytic power here, however, takes the third place. The minimum catalase was found at 80-90 cm., though this zone is nearly as rich in carbonate as the vegetable mould. Though there appears no definite relation between the calcium carbonate content and the catalase, yet a certain tendancy thereto can be observed here. The soils showing the greatest catalytic force (Hustopec, vegetable mould, subsoil No. 1, Slapanice 85 vegetable mould) are richer in lime than soil of the lowest catalytic force (Radomin UG1,2, Hodonin UG1,2) (This result agrees with von KOENIG's).

If the soil catalase is partly of bacterial origin, then there must be a certain correlation between soil catalase and soil reaction. The degree of the constant and variable reaction of the soils examined is given in Table I (30 gms. of soil were shaken for 1 hour in 100 cc. of water, or with KCL, and the pH filtrate determined by MICHAELIS' colorimetric method).

Though neither the degree of variable, nor that of constant reaction always corresponds with the catalytic force of the soil, yet we find that the soil with the highest catalase showed the highest constant (pH Hustopec A. UG 1., Slapanice 84 A.). On the other hand the soils with the lowest catalase (Radomin UG 1,2, Hodonin UG 1,2) showed less or very little pH. This rather marked tendency is also related to the calcium carbonate content.

A further test was made in order to discover how the hydrogen-peroxide catalase changes after partial sterilisation of the soil by heating (22). The soil was dried at 50° and 100° C. until constant weight was obtained. The catalytic force of the soil thus dried is as shown in Table II, columns *b*, *c*.

From this Table it is evident that in many types, when dried at 50° C., the catalytic force increases (Hulin, Slapanice 84 UG., Slapanice 85, somewhat also in the case of Radomin, Hrušovany-Sanov A., partially in that of Ivanovice and Hustopeč), while in other types it fell. A small majority show a slight decrease in catalytic force.

The catalytic force decreased after the partial sterilisation of the soil at 100° C. Only a few exceptions were found in subsoils at a great depth.

Tests were also made to discover how this soil force changes on boiling (23). The soil was boiled in water for 1 minute, and immediately after cooling hydrogen peroxide was added. The coucentration wos such that a quantity of H_2O_2 equal to that used in the other tests was used in the treatment, so that the results could be compared. In this way the values given in Table II, column *d* were obtained.

Boiling generally, diminished the catalytic force of all soils. This sterilisation greatly resembles in its effect the of results dry heating at 100° C. If a comparison is made of the differences obtained by subtracting the volume of the liberated oxygen before and after sterilisation of the soil, the data in Table IV result.

From the Table IV it is evident that from partial sterilisation of soil by dry heat at 100° C, most of the upper layers, or those next to them, suffer (Hustopeč 35-45 and Pošlorná 60-70 are exceptions). This is in harmony with the atmospheric pressure which similarly decreases in the sections. As other authors have already shown, no relation between the numbers of organisms can be expected, for different species have a different capacity for liberating molecular oxygen from the hydrogen peroxide (certain staphylococci and sarcinae exert the greatest influence).

If we observe the difference in catalytic force between air-dried and boiled soils, the proportions are similar to those already mentioned (Hustopeč 35-45, Tichà 150-160 and Hodonin 200, for instance, are exceptions).

Nostitz (24) thinks that the catalase at greater depths decreases like the soil fertility and the humus and nitrogen content.

How the soil catalase changes on heating to a dull, red heat may be seen from the following examples, Table V.

If these figures are compared with those in Table II, column *a*, a great decrease is found in the liberated oxygen. Comparatively the greatest catalytic force is retained after heating to a red theat, by those types having a higher lime content, namely Hulin at 300 cm. and Slapanice at 140 cm. This is probably due to the chemical and mineral composition of the soil components (25).

TABLE IV.

Origin	Depth in cm.	Difference in the amount of oxygen liberated from the soil before and after sterilisation			
		By drying at 100° C.		By boiling in water	
		after 5′	after 10′	after 5′	after 10′
I. — AGRICULTURAL SOILS.					
1. Hulín	10–20	—	13.8	—	6.7
»	30–40	—	9.8	—	3.2
»	60–70	—	5.1	—	0
»	90–100	—	2.0	—	3.7
»	120–130	—	1.8	—	6.8
»	300–310	—	—	—	—
2. Brešt-Hulín	10–20	4.4	4.4	6.6	5.7
»	20–30	6.6	6.4	22.0	10.1
»	40–50	9.6	—	—	—
3. Slapanice 84	20–30	2.5	—	11.5	—
»	40–50	— 6.8	—	— 10.4	—
»	60–70	— 4.8	—	— 8.0	—
»	120–130	— 0.2	—	8.2	—
»	140–150	1.6	0.4	—	—
4. Slapanice 85	10–20	—	—	—	2.8
»	40–50	8.6	—	1.7	2.2
»	80–90	3.2	— 0.1	— 0.6	— 0.8
»	130–140	3.1	— 1.4	—	—
5. Ivanovice	10–30	7.4	—	28.2	—
»	44–60	5.2	—	17.4	—
»	60–75	— 5.2	—	— 0.2	—
»	80–	1.8	—	11.8	6.0
6. Hrušovany-Sanov	20–30	1.6	—	— 0.8	—
»	90–100	1.8	1.2	10.8	12.2
Hrabetice	10–20	6.8	8.6	11.4	11.8
7. Huštopec	5–15	4.4	—	4.0	—
»	20–30	—	—	—	—
»	35–45	6.4	3.2	14.6	8.4
»	80–90	0.2	— 2.1	12.6	12.3
8. Olomouc	20–30	10.6	12.8	10.6	12.8
»	50–60	4.2	5.2	6.2	6.0
» Upper Ortstein	60–65	3.8	—	—	—

TABLE IV (*continued*).

Origin	Depth in cm.	Difference in the amount of oxygen liberated from the soil before and after sterilisation			
		By drying at 100° C.		By boiling in water	
		after 5′	after 10′	after 5′	after 10′
8. Olomouc Lower Ortstein	75–80	4	4.7	9 2	10.8
9. Hodonin	10–20	5.2	5.6	5.3	5
»	35–45	2.6	3.3	4.4	4.3
»	80–90	3.2	3.2	3.2	2.9
»	250–	— 1.9	— 3.0	13.7	15.8
10. Hrušovany	10–20	6.3	6.8	10.8	11.8
»	30–40	4.4	—	40.0	—
»	70–80	— 1.6	—	14.4	—
»	150–160	— 8.2	—	6.8	5.0
11. Postornà	10–20	4.0	5.0	9.2	10.2
»	30–40	4.1	3.6	11.7	12
»	60–70	6.0	6.4	8.5	8.2
»	250–260	3.2	3.6	9.4	10.2
12. Val Mezerici	10–20	10.6	12.2	9.9	9.6
»	30–40	11.4	14.5	12.8	11.8
»	60–70	4.2	4.8	10.7	9.8
»	120–130	— 0.1	— 0.5	8	7.6
13. Radonin	8–13	11	14.4	4	2.8
»	30–40	1.3	1.8	1.7	2.2
»	80–90	2.2	1	— 0.6	— 0.8
14. Tichà	5–15	9.4	16.5	13.6	16.2
»	20–30	6.4	7.5	9.8	3.2
»	70–30	—	—	—	—
»	150–160	4.3	6.3	18.4	19.1
II. — FOREST SOILS.					
15. Adamov	0–3	32	43.9	16.8	25.3
»	3–17	8.6	10.6	12.4	14.6
»	17–34	6.8	8.2	16.4	21.6
»	34–49	9.8	11.0	13.8	11.6
»	49–74	9.2	12.6	13.2	14.0

TABLE V.

Origin	Depth in cm	Time	O_2 in cc
Hulin . . .	10–20	5 10	3.3 3.2
» . .	30–40	5 10	2.5 1.4
» .	300–310	5 10	28.8 48.2
Tichà	5–15	5 10	2.5 1.4
»	20–30	5 10	2.8 1.7
Slapanice 84	140–150	5 10	32.5 45.2

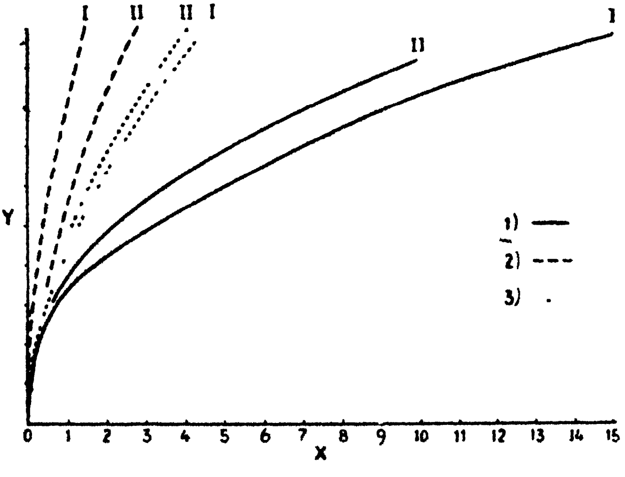

FIG 57 — Intensity of oxygen liberation
Y = cc oxygen, X = Time in minutes
1) ——— at 17° C
2) . . at 37° C
3) - - - - at 60° C
I = Hulin mould at 10 cm, II = Ticha mould at 5 cm

The extent of the action of oxygen liberation at temperatures of 17°, 37° and 60° C may be illustrated by graphs (Fig 57)

From the foregoing diagram it is seen that with an increase of temperature during the reaction the quantity of oxygen liberated is greater at the same H_2O_2 concentration (See Hulin 10-20 cm., Ticha 5-15 cm).

How the quantity of oxygen liberated under the influence of a different hydrogen-peroxide concentration varies, may be seen from the following diagram (Fig. 58).

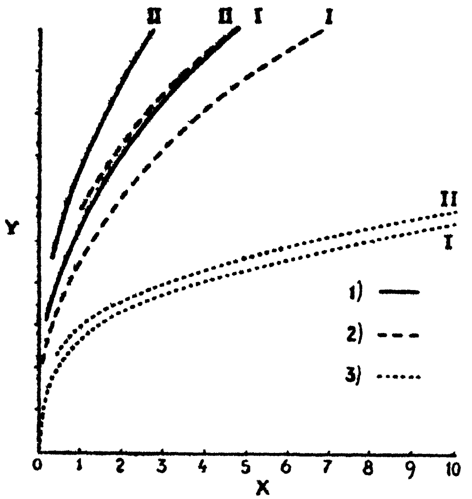

Fig 58 — *Variation in the quantity of oxygen liberated under the influence of hydrogen-peroxide concentration.*

Y = cc. Oxygen ; X = Time in minutes
1) ——— 20 % H_2O_2
2) – – – – 10 % »
3) . . . . . 1 % »
I = Hulin vegetable mould at 10 cm ; II = Ticha vegetable mould at 5 cm.

A higher concentration at the same temperature is accompanied by an increase in the quantity of oxygen liberated

From all these results it is clear that the catalytic force of soils cannot be brought into close relation with any one of the characteristic soil properties mentioned. No general close connection was found between the physical composition, hygroscopicity, calcium carbonate content or degree of reaction, either constant or variable. This may perhaps be understood up to a certain point. If this property of the soil depends on the humus content, then it must be greatest in the vegetable mould and upper layers. As, however, it is influenced by various oxides (iron, manganese) in the subsoil it must increase with the depth. As lime also and a whole series of other elements in the soil come into play, it is clear that the hydrogen-peroxide catalase cannot be brought into correlation with any single property of the soil.

The concluding results obtained can therefore only be considered as certain tendencies, which become evident on studying the analysis data, and in no way as definite functions.

Summary.

The object of this investigation was to determine the hydrogen-peroxide catalase in types of marsh soil, and to find out how it changes after partial sterilisation at a temperature of from 50°-

100° C, after boiling, or finally, after heating to a red heat, and how various temperatures and H_2O_2 concentrations during the reaction show their influence, and to bring them into relation with:

(1) the physical composition;
(2) the hygroscopicity (27);
(3) the carbonate content;
(4) the constant and variable soil reaction.

The results of the investigation are as follows:

(1) In the subsoils treated, the hydrogen-peroxide catalase increased with the depth, as likewise the hygroscopicity and constant and variable pH concentration.

(2) The soils having the greatest catalytic force showed a higher constant pH and at the same time a higher calcium carbonate content. On the contrary, soils with the lowest catalase showed a lower constant pH reaction.

(3) After drying the soils at 50° C. the catalytic power altered irregularly. In some soils it increased, in others it diminished. After drying the soils at 100° C, also after boiling in water for a minute, the catalytic power of the great majority of the soils diminished. After heating the soils to a dull red heat the catalytic power diminished in all cases, but irregularly.

(4) With an increased H_2O_2 concentration the quantity of oxygen liberated also increased.

(5) With a higher temperature during the reaction the quantity of oxygen liberated also increased.

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NOTES AND BIBLIOGRAPHY.

(1) WOLF: Die chemischen Forschungen, 1847.
(2) *Landw. Jahrbuecher* 21, 1892.
(3) *Zentralblatt f. Bakteriologie* II. Abt. 1906.
(4) Lehrbuch der Chemie, 1840.
(5) *Journal f. prakt. Chemie,* 1868.
(6) *Landw Versuchsstat.,* 1907.
(7) Bakteriol. Untersuch. ue. Tschernozem-Diss., 1911.
(8) KOENIG u. s. w. Landw. Versuchst., 1907.
Von L. BOHNSON and A. C. ROBERTSON: Die katalyt. Zersetzung von Wasserstoffsuperoxyd durch Ferrisalze. II. *Journ. Physic. Chem.* 25, 19, c. 1921.

(9) Cameron and Bell (Oxydasen) Woods (Peroxydasen) See under 6).

(10) Die Tschernosem-erden ragen durch eine ausserordentlich hohe katalytische Kraft hervor. Nach Papa Kalantarinian (5 g Erde + 400 cc 3 % H_2O_2 ergeben nach 30″ z B 455 cc O See under 7, S 62.

(11) Papa Kalantarian fuerth an, dass Chloroform sehr ungleich auf verschiedene Boeden wirkte Bei einigen Boeden setzte es die katalytische Kraft nur sehr undeutlich herab, bei manchen erhoehte sie sogar diese.

(12) Versuche eine Beziehung zwischen der chemischen Zusammenstzung des Humus und der katalytischen Kraft des Bodens zu finden. See Smolík, IVth Soil Science Congress, Rome, 1924

(13) The catalase of soils, *Porto Rico Agric Exp Station Circular* 9, 1909.

(14) H Grossmann, *Landw Versuchstat*, 1908

(15) *Comptes rendus hebd d séances d l'acad. des sciences*, p. 1842. 1924

(16) Gertrud Woker (1914) haelt die Peroxydase, Katalase, und die Reduktase fuer Enzyme von Aldehydcharakter Ihr widerspricht A Bach (1924) der verschiedene Enzyme (auch Katalase) herstellte, aber die Eigenschaften von Aldehyden nicht vorfand

(17) Smolik, Ueber Menge und Charakter der Matiere noire in den maehrischen Boeden, 1924

(18) Bodenkunde III

(19) *Milchwirtschaftliches Zentralblatt*, 1910

(20) Einige Veraenderungen der Katalase des Bodens bei Veraenderungen der gesammten Bodenoberflaeche sind angefuehrt in Smolik, Beitrag zu den dyskolloiden Veraenderungen des Bodens, Zemedel Archiv, 1924

(21) Es handelt sich hier um ein saures Profil Der Austauschkalk wurde bestimmt durch Extraction mit n-KCl

(22) Papa Kalantarian vollzog die Sterilisation bei 2 Atm. Ueberdruck bei einer Temperatur von 133°, um nicht nur die Bakterien sondern auch die Enzyme zu vernichten See No 7.

(23) Siehe unter 15

(24) *Landw Jahrbuecher* 47, 1914

(25) Interessant ist, dass die Schwarzerden — nach Papa Kalantarian — durch Gluehen annarhernd gleich leiden Der Autor meint, dass man daraus auf eine annarhernd gleiche mineralogische Zusammensetzung der Schwarzerden schliessen koenne

(26) Die Angaben von cc Sauerstoff sind nicht reduziert auf Atmosphaerendruk

(27) H koagulieren die Bodenkolloide Nach Aarnio kann man daher eine Beziehung zwischen den H″ im Boden und der Hygroskopicitaet suchen, Bei dem Adamover Profil sehen wir tatsaechlich, dass in den Untergruenden, wo die aktuelle Aciditaet am geringsten ist (pH am groessten) die Hygroscopicitaet steigt

THE HELP OF GRAPHS IN KOPECKY'S SCALE FOR SOIL CLASSIFICATION BY MECHANICAL ANALYSIS.

The soil cleansing apparatus of Prof. KOPECKY, as experience shows, is now increasing in importance, especially amongst agricultural scientists. Its success is naturally greatly enhanced by its easy manipulation, automatic working and the short time occupied by the analyses. This apparatus has been largely introduced into the Chechoslovakian Republic and used also in connection with maps, with excellent results.

As further experience shows, however, the examination of the character of the soil type by the process of mechanical analysis, for which investigation a special classification scale was drawn up by Prof. KOPECKY (1), is often attended with certain difficulties. Especially in mechanical analyses and in laboratory work at the Technical High School, the analyst students have always had to search in the scale in order to get together the right description according to the analytical data. This led me to draw up a simple scheme (graph), by means of which the description of the soil type desired could immediately be ascertained.

This plan is based on Prof. KOPECKY's classification scale, which takes into consideration chiefly two kinds of particles, viz., I. particles with a diameter of less than 0.01 mm. (the finest particles which may be held in suspension) and II. particles with diameter of from 0.01-0.05 In the diagram the data for the percentage content of particles of category I. in the soil type are shown in the vertical figures and the similar percentages of particles of category II. are shown in the horizontal figures.

If, therefore, following the analysis data, the corresponding figures of category I. be found in one column and those of category II. in the other, *the intersection of these lines shows the description as per classification* of the soil type under examination. For instance:

I. 55 %, II. 35 % . . . " Clay-loamy Soil "
I. 8 %, II. 35 % . . . " Slightly Loamy Sand " etc.

As, in the scale, for the outside space I. 0-10 %, and II. over 45 %, no allowance has been made, we have supplied Prof. KOPECKY's deficiency by inserting the corresponding " Loess Soil ".

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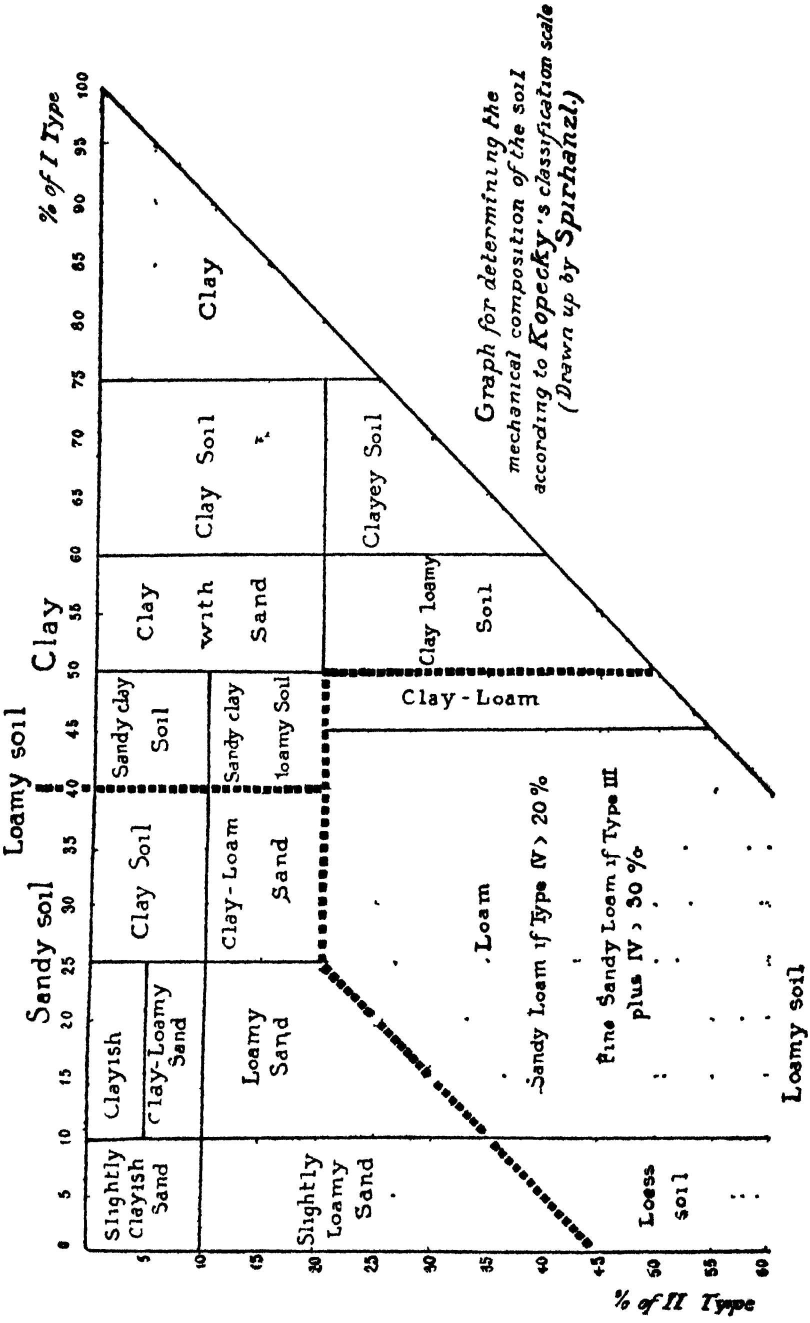
(1) " *Soil Type Classification* " - Prague, 1913, part. 22.



Graph for determining the mechanical composition of the soil according to Kopecky's classification scale (Drawn up by Spirhanzl.)

On the plan, the gradual change from sand to clay may very easily be followed. In addition, the individual character of the separate soil types, through their position in the common space is brought out very clearly, and a reference to the neighbouring group will also allow of the properties of each group being determined, and further, from the position of the point of contact in the single group space, by reference to the neighbouring spaces the properties of the soil type can be determined. If, for instance, the point of contact I. 20 % and II. 27 % lies near the " Loamy Sand " group, it is clear that the analysed loam will be very sandy,. . . and so on. Also, in the plan, the chief groups, Sand, Loam and Clay Soils, are enclosed by thick lines.

The simplicity of application of this diagram has been so far appreciated that it is already in general use for practical soil science at the Technical High Schools in Bohemia and the work of the students is thereby considerably lightened.

Eng. Jar. SPIRHANZL,
Prague, Czechoslovakia.

THE INFLUENCE OF NEUTRAL SALTS ON SOIL REACTION.

It has long been known that neutral salts modify soil acidity. At first these modifications were measured by titration, but recently KAPPEN (5, 9), among others, has investigated the removal of the actual acidity by the addition of salts.

As very few systematic determinations of the reaction of different salts and soils had been made with this object, the author began these investigations some years ago. After the first series of tests had been made, it became evident that the colorimetric method did not give sufficiently exact results. The investigations therefore had to be made by the electrometric method *, but were delayed by the fact that the author hitherto had no suitable instruments at his disposal.

For the proposed tests, an acid and an alkaline loam soil, a sandy soil and an undecomposed sphagnum peat were used.

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* The pH determinations were kindly made by Miss S. HEINZE.

TABLE I.

TABLE I.

Concentrations	KCl		KNO_3		K_2SO_4		$NaCl$		$NaNO_3$		Na_2SO_4		NH_4Cl		NH_4NO_3		$(NH_4)_2SO_4$		$CaCl_2$		$CaNO_3$		$MgCl_2$		$MgSO_4$		$FeCl_3$	
	pH	ac.	pH	ac.	pH	ac.	pH	ac.	pH	ac.	pH	ac.	pH	ac.	pH	ac.	pH	ac.	pH	ac.	pH	ac.	pH	ac.	pH	ac.	pH	ac.
Alkali Loam Soils																												
0	7.93	0.00	7.92	0.000	7.92	0.00	—	—	—	—	7.92	0.000	7.92	0.0	7.92	0	—	—	7.92	0	—	—	7.94	0	—	—	7.92	0
0.00003	7.92	0	7.98	0	7.90	0.0	7.90	0	7.94	0	7.92	0	7.92	0	7.90	0	7.90	0	7.90	0	7.90	0	7.92	0	7.90	0	7.92	0
0.0001	7.92	0	7.92	0	7.90	0	7.90	0	7.94	0	7.92	0	7.92	0	7.90	0	7.90	0	7.85	0.015	7.90	0	7.92	0	7.90	0	7.84	0.015
0.0003	7.87	0.01	7.92	0	7.90	0	7.85	0.015	7.04	0	7.92.	0	7.92	0	7.81	0.03	7.90	0	7.81	0.03	7.85	0.01	7.84	0.015	7.90	0	7.84	0.015
0.001	7.82	0.02	7.79	0.05	7.83	0.02	7.85	0.015	7.87	0.01	7.86	0.01	7.75	0.0	7.75	0.04	7.85	0.015	7.73	0.05	7.76	0.03	7.80	0.03	7.80	0.03	7.50	0.10
0.003	7.68	0.06	7.92	—	7.75	0.04	7.80	0.03	7.87	0.01	7.90	0	7.69	0.0	7.68	0.06	7.70	0.05	7.65	0.06	7.64	0.07	7.69	0.06	7.60	0.08	7.19	0.26
0.01	7.54	0.09	7.53	0.095	7.64	0.07	7.75	0.04	7.75	0.04	7.79	0.03	7.55	0.0	7.50	0.10	7.60	0.08	7.38	0.07	7.40	0.16	7.52	0.09	7.50	0.10	5.00	1.08
0.03	7.30	0.21	7.40	1.055	7.45	0.13	7.68	0.06	7.67	0.06	7.75	0.04	7.42	0.1	6.39	0.16	7.50	0.10	7.20	0.26	7.24	0.24	7.35	0.18	7.41	0.15	2.98	—
0.1	7.28	0.22	7.31	0.205	7.39	0.16	7.58	0.08	7.56	0.085	7.71	0.05	7.29	0.2	7.25	0.23	7.35	0.18	7.00	0.37	7.00	0.37	7.25	0.24	7.34	0.19	—	—
0.3	7.29	0.22	7.30	0.21	7.39	0.16	7.50	0.10	7.50	0.10	7.68	0.06	7.18	0.2	7.18	0.28	7.35	0.18	6.83	0.44	6.87	0.44	7.20	0.26	7.30	0.21	—	—
1.0	7.29	0.22	7.30	0.21	7.84	0.02	7.45	0.13	7.46	0.135	7.65	0.065	7.00	0.	7.07	0.33	7.27	0.23	6.58	0.65	6.20	0.84	7.04	0.35	7.24	0.26	—	—
1	7.22	0.25	7.25	0.235	—	—	6.81	0.41	6.10	0.92	7.76	0.04	6.30	0.	6.64	0.60	6.73	0.55	6.10	0.93	—	—	6.10	0.93	6.54	0.68	—	—
Acid Loam Soils																												
0.00000	5.05	0.00	—	—	—	—	—	—	—	—	5.05	0.000	5.05	0.00	—	—	—	—	5.05	0	—	—	5.05	0	—	—	5.05	0
0.00003	5.05	0	—	—	5.05	0	—	—	—	—	5.05	0	5.00	0.01	5.05	0	5.05	0	5.05	0	5.05	0	5.05	0	—	—	5.05	0
0.0001	5.06	0	5.06	0	—	—	—	—	—	—	5.10	0.01	5.00	0.01	5.05	0	5.05	0	4.96	0.02	5.05	0	5.05	0	—	—	4.98	0.01
0.0003	5.06	0	0.06	0	5.05	0	—	—	—	—	5.05	0	5.00	0.	.05	0	5.05	0	5.00	0.015	5.10	0.01	5.05	0	—	—	4.86	0.05
0.001	4.86	0.04	4.86	0.04	4.93	0.03	5.06	0	5.06	0	4.96	0.03	4.90	[illegible]	.90	0.04	5.00	0.01	4.78	0.06	4.81	0.03	5.05	0	5.00	0.01	4.67	0.08
0.003	4.64	0.10	3.58	0.12	4.76	0.07	4.96	0.03	5.00	0.01	4.92	0.03	4.75	0.	4.75	0.07	4.75	0.07	4.59	0.11	4.56	0.13	4.77	0.06	4.82	0.05	3.98	0.09
0.01	4.47	0.10	4.45	0.16	4.56	0.13	4.77	0.06	4.77	0.06	4.85	0.04	4.53	0.13	4.55	0.13	4.64	0.10	4.46	0.15	4.47	0.15	4.57	0.13	4.65	0.09	2.98	1.10
0.03	4.20	0.25	4.25	0.23	4.40	0.17	4.61	0.11	4.58	0.12	4.77	0.07	4.35	0.19	4.35	0.19	4.46	0.13	4.28	0.21	4.28	0.21	4.47	0.15	4.54	0.13	—	—
0.1	4.10	0.31	4.10	0.31	4.32	0.19	4.47	0.11	4.50	0.14	4.65	0.10	4.10	0.31	4.10	0.31	4.36	0.19	4.10	0.31	4.14	0.28	4.31	0.20	4.45	0.16	—	—
0.3	4.05	0.34	4.05	0.35	4.30	0.22	4.29	0.22	4.25	0.22	4.53	0.13	4.04	0.35	4.04	0.35	4.36	0.19	4.04	0.35	4.04	0.35	4.14	0.29	4.37	0.19	—	—
1.0	3.90	0.43	3.90	0.43	4.42	0.16	4.11	0.30	4.09	0.30	4.75	0.07	3.96	0.40	3.96	0.40	4.16	0.15	3.90	0.43	3.96	0.40	3.97	0.39	4.28	0.21	—	—
1	3.90	0.43	3.90	0.43	—	—	3.79	0.48	3.92	0.41	4.75	0.07	3.74	0.52	3.80	0.43	4.20	0.21	3.06	0.55	3.58	0.60	3.46	0.69	4.09	0.31	—	—
Sandy Soils																												
0.00000	5.13	0.00	—	—	—	—	5.13	0.000	—	—	—	—	5.13	0.00	—	—	—	—	5.15	0	—	—	5.15	0	—	—	—	—
0.00003	5.07	0.01	5.15	0	5.15	0	5.14	0	5.12	0	5.12	0	5.13	0	5.10	0	5.12	0	5.15	0	5.15	0	5.15	0	5.15	0	5.05	0.01
0.0001	5.10	0.01	5.10	0.01	5.15	0	5.14	0	5.12	0	5.12	0	5.12	0	5.07	0.01	5.10	0	5.15	0	5.15	0	5.15	0	5.15	0	5.15	0
0.0003	5.07	0.01	5.05	0.01	5.15	0	5.16	0	5.14	0	5.12	0	5.10	0.01	5.07	0.01	5.04	0.01	5.09	0	5.09	0	5.09	0	5.10	0	4.98	0.02
0.001	4.99	0.01	4.99	0.01	5.04	0.01	5.14	0	5.10	0.01	5.10	0.01	5.00	0.02	5.07	0.01	4.96	0.92	4.93	0.03	4.90	0.03	4.98	0.02	4.98	0.2	4.50	0.10
0.003	4.90	0.04	4.96	0.02	4.91	0.03	5.00	0.01	5.00	0.01	5.04	0.01	4.90	0.04	4.90	0.04	4.90	0.04	4.72	0.06	4.53	0.06	4.81	0.05	4.85	0.05	3.67	0.30
0.01	4.74	0.06	4.70	0.07	4.80	0.05	4.90	0.04	4.91	0.04	4.96	0.02	4.74	0.06	4.74	0.06	4.70	0.06	4.53	0.09	4.53	0.09	4.65	0.07	4.70	0.07	2.84	0.69
0.03	4.57	0.08	4.57	0.08	4.70	0.07	4.77	0.06	4.86	0.04	4.90	0.04	4.59	0.0	4.61	0.08	4.61	0.08	4.33	0.13	4.33	0.13	4.48	0.10	4.58	0.08	—	—
0.1	4.41	0.11	4.41	0.11	4.59	0.08	4.65	0.07	4.05	0.07	4.82	0.05	4.47	0.1	4.15	0.10	4.57	0.08	4.17	0.15	4.19	0.15	4.33	0.13	4.46	0.10	—	—
0.3	4.30	0.13	4.32	0.13	4.42	0.08	4.64	0.10	4.46	0.10	4.72	0.06	5.27	[illegible]	.30	0.13	4.50	0.09	4.09	0.17	4.07	0.17	4.17	0.16	4.40	0.11	—	—
1.0	4.26	0.14	4.26	0.14	4.74	0.06	4.27	0.14	4.31	0.13	5.00	0.01	4.15	[illegible]	.16	0.16	4.57	0.08	3.93	0.20	3.93	0.20	4.10	0.17	4.36	0.12	—	—
1	4.16	0.16	4.22	0.15	—	—	4.20	0.15	4.11	0.16	5.20	0.01	—	[illegible]	3.99	0.19	4.36	0.12	3.70	0.29	3.70	0.29	3.57	0.34	3.58	0.20	—	—
Peat																												
0	5.23	0.00	—	—	—	—	—	—	—	—	—	—	5.26	0.00	—	—	—	—	5.26	0	—	—	—	—	—	—	5.26	0
0.00003	—	—	—	—	—	—	—	—	5.26	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	5.30	0.10
0.0001	—	—	5.26	0.000	—	—	—	—	5.26	0.000	—	—	—	[illegible]	—	—	—	—	5.26	0	—	—	—	—	—	—	5.26	0
0.0003	5.26	0.00	5.26	0.000	—	—	—	—	5.26	0.000	5.26	0.000	—	[illegible]	—	—	—	—	5.26	0	5.26	0	—	—	—	—	5.26	0
0.001	5.25	0.00	5.25	0.000	5.26	0.00	—	—	5.26	0.000	5.20	0.18	5.26	0.0	—	—	5.26	0	5.26	0	5.25	0	5.26	0	—	—	5.16	0.24
0.003	5.26	0.00	5.20	0.18	5.30	0	5.26	0.000	5.26	0	5.20	0.18	5.26	0	5.26	0	5.20	0.18	5.16	0.25	5.22	0.10	5.21	0.18	5.21	0.10	5.16	0.24
0.01	5.19	0.21	5.19	0.21	5.30	0	5.16	0.24	5.26	0	5.20	0.18	5.08	0.31	5.08	0.31	5.14	0.27	5.07	0.33	5.07	0.33	5.08	0.31	5.14	0.27	4.74	0.89
0.03	5.16	0.24	5.18	0.22	5.26	0	5.10	0.31	5.21	0.17	5.20	0.18	5.08	0.01	5.08	0.31	5.14	0.27	4.99	0.43	5.00	0.40	4.97	0.47	5.05	0.36	4.18	—
0.1	5.10	0.31	5.10	0.31	5.26	0	5.04	0.37	5.15	0.25	5.18	0.22	4.98	0.44	4.98	0.44	5.12	0.29	4.77	0.83	4.80	0.77	4.81	0.75	4.92	0.58	2.87	—
0.3	5.07	0.34	5.08	0.32	5.16	0.24	4.94	0.53	5.04	0.37	5.10	0.31	4.88	0.62	4.86	0.65	5.05	0.33	4.55	1.24	4.55	1.24	4.68	1.00	4.81	0.74	—	—
1.0	5.00	0.41	5.00	0.41	5.35	0.20	4.84	0.70	4.94	0.52	5.15	0.26	4.78	0.81	4.94	0.70	5.05	0.33	4.31	1.64	4.37	1.55	4.44	1.43	4.72	0.92	—	—
1	4.81	0.70	4.98	0.44	—	—	4.65	1.05	4.86	0.66	5.15	0.26	4.60	1.15	4.80	0.78	4.83	0.71	3.77	—	3.90	—	3.78	—	4.33	1.60	—	—

The tests were made in the following manner. 10 gm. of dried soil were mixed with 100 cc. of salt solution. The following concentrations were used: 0; 0.00003; 0.0001; 0.0003; 0.001; 0.003; 0.01; 0.03; 0.1; 0.3; 1.0; in addition, a still higher degree of concentration was used, being, for the various salts, as follows:

KCl	KNO_3	$NaCl$	$NaNO_3$	Na_2SO_4	NH_4Cl
3.00	2.16	5.40	5.53	1.71	4.94
NH_4NO_3	$(NH_4)_2SO_4$	$CaCl_2$	$Ca(NO_3)_2$		
5.07	5.19	3.47	5.53		
$MgCl_2$	$MgSO_4$				
5.08	4.15-n				

The samples were shaken by hand several times, and allowed to stand over night in closed vessels and the next day the determinations were made by the quinhydroneelectrode (BIILMANN, 4) on the soil deposits.

The results of these determinations are given in Table I (sse page 124-125).

(In these Tables "concentration" means concentration of salts solution, "pH", hydrogen concentration).

As the acidity modifications through titration were also of interest, the titration curves of the different soils were determined.

TABLE II.

Titration of the different soils.

		1	2	4	6	8	10
cc. of Acid . . .	0	2	4	6	8	10	
Alkali Loam. . . .	7.92	7.50	7.95	6.90	6.65	6.36	5.80
Acid »	5.05	4.64	4.30	3.95	3.60	3.18	3.10
Sandy Soil.	5.16	4.48	3.94	3.43	3.00	2.71	2.56
Peat	5.26	5.22	5.20	5.00	4.90	4.76	4.68

10 gms. of dry soil were mixed with various quantities of sulphuric acid and then diluted to 100 cc.

As however in this investigation only the question of acidification was dealt with, only the acid sections of the titration curves were determined (1). From the curves thus obtained (Fig. 59), the quantity of liberated acid was estimated by a graph. These values are shown in the Table I under « ac. ».

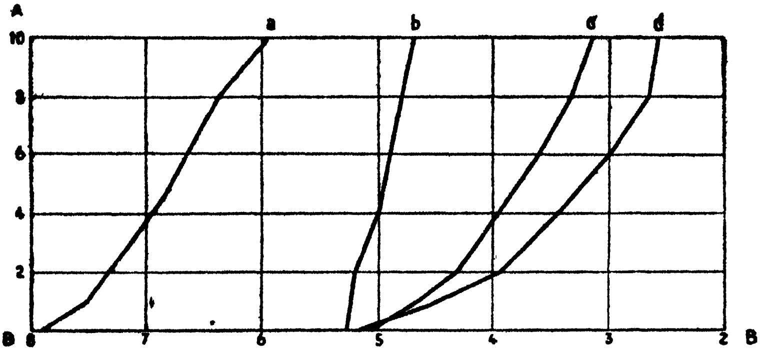

FIG. 59. — Acid set free.
A = H_2SO_4 per gm. of dry soil; B = pH.; *a* = alkaline loam.; *b* = peat soil; *c* = acid loam; *d* = sand.

The origin of the acidification is usually attributed to the so-called potential acidity (7). This might be represented by the following equation :

$$HBd + CaCl_2 = HCl + CaBd$$

provided the salt added be $CaCl_2$ and the acid soil substance, Bd. Through the formation of salts there should be an increase of acidity. The acidity however does not depend on the quantity of acid available, but on the H-ion concentration. But this does not vary according to the equation. FREUNDLICH (6) points out that it is very probable that, as stated by ROTHMUND, the basic variation may be explained by the formation of a strong solution, that is, the phenomenon may be defined as a separation of the salts present into two solvents. If this explanation is sound, it will be still more difficult to explain the potential acidity as a phenomenon of adsorption. If the potential acidity really existed, the phenomena could be estimated by the FREUNDLICH formula. As previously mentioned (3), however, the author has shown that this is not the case if the hydrogen-ion concentration be calculated on this formula, without taking into consideration the buffer-action of the soil.

It might be said that it is the quantity of acid formed, and not the hydrogen-ion concentration, which depends on the concentration of the salt solution. Were the increase in acidity a variable phenomenon, the logarithmic values, represented by a graph, would form a straight line. From Figs. 60 and 61, however, it will be seen that this is not the case; the lines are curved, and this is also the case with Daikuhara's values (5).

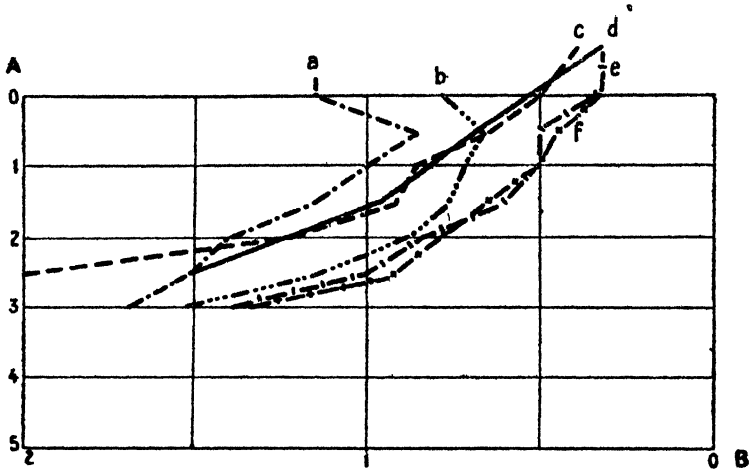

Fig 60. — Hydrogen-ion and Salt Concentration in Acid Loam Soils.
A = Log. Concentration; B = Log. "Liberated" Acid.
a = Na_2SO_4; *b* = K_2SO_4; *c* = $NaNO_3$: *d* = $NaCl$; *e* = KCl: *f* = KNO_3.

Another arguement against the explanation of the phenomena as variable is that alkaline loam, also according to Ramann an adsorbent saturated soil, in some cases, both in actual and titration acidity, has undergone greater changes than acid loam. In other instances the contrary is the case. There is therefore no rule that the adsorbent unsaturated soil can take up more cations from the salt solutions than the adsorbent saturated soil.

Hence it appears as though the definition of increased acidity as a variable phenomenon is not tenable. How then can the matter be explained? One way of explaining it is by assuming that neutral salts exert an influence. If a dilute acid solution be mixed with a stronger neutral salt solution it gives rise to an increased acidity. (In some cases also a decreased acidity may be the result.)

This is accounted for by the fact that the hydrogen-ions are stimulated, or that the OH-ions are expelled, whereby an apparent increase in acidity takes place.

Exactly the same phenomenon takes place if quartz, permutit, cotton or similar substances be treated with neutral salt solutions. It would be very useful to explain the soil phenomenon from the same point of view.

From the Tables it will be seen that the chlorides exercise the greatest influence, and the nitrates come next; the sulphates have the weakest influence. The same order will be found in ACKERLOEF's works (8).

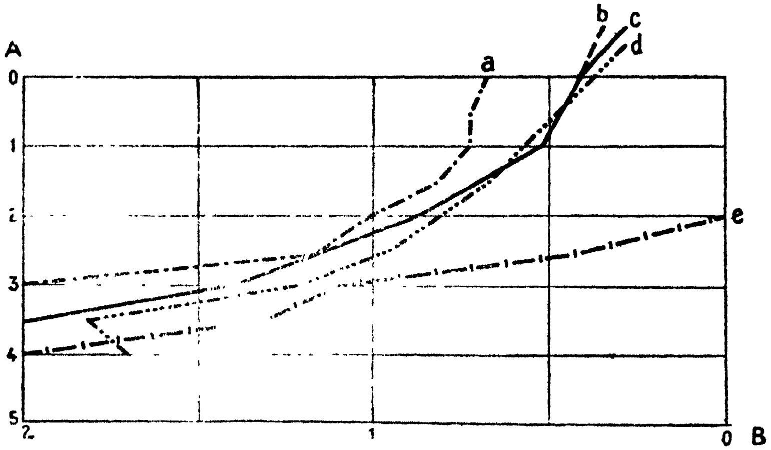

FIG. 61. — Hydrogen-ion and salt concentration in acid loam soils.
A = Log. concentration; B = "Liberated" acid.
a = $(NH_4)_2 SO_4$; b = $NH_4 HO_3$; c = $NH_4 Cl$; d = $Ca Cl_2$; e = $Fe Cl_2$.

Among the cations, Fe has the strongest influence, then come the Ca, Mg, K, NH_4 and Na series. These facts justify us in regarding the phenomenon as brought about under the influence of neutral salts.

The greater the buffer reaction of the substances treated, the stronger is the modification of their acidity.

By explaining the influence of the salt solutions in this way, the question of soil acidity will be simplified; the same kind of acidity exists before and after the addition of the salts, there is therefore no new acidity, which moreover would be very difficult to define.

⁂

The extent to which soil acidity is affected by the addition of artificial fertilisers is of great interest as regards manuring. In certain cases even, mineral fertilising may be a failure, for it gives rise to too strong acidity, which, after the investigations on soil reactions made in recent years (2), may be easily understood.

Large quantities of manure are generally added to sugarbeets. In order to give a clear idea of this question, a summary of the frequency of various additions of potash and Chili nitrate made to the soil in an agricultural district in the south of Sweden are here given:

TABLE III.

Frequency of manuring to soil under sugarbeet.

Amount added	0	100	200	300	400	500	750 kg. ha.
40 % potash	221	109	234	24	18	—	2
Chili nitrate	27	26	163	205	165	8	4

Supposing an addition of 200 potash and 400 kg. Chili nitrate per ha. be made, this, assuming that the water content of the soil be 15 % and the weight of one ha. 3,000,000 kg., corresponds to a 0.0045 % of potash solution and a 0.009 % of nitrate solution. For pure salts (this has no practical application) the concentrations would be: a 0.0011-n NO_3 solution and a 0.0006-n KCl solution. From Table 1 it will be seen that these concentrations correspond to the following acidity modifications:

	$NaNO_3$	KCl
Alkaline Loam Soil	0.2	0.3
Acid " "	0	0.1
Sandy	0	0.1
Peat	0	0.1

As will be seen, the modifications are very slight after these additions of fertiliser. It must also be borne in mind that a very low water content has been allowed for here. But with the addition of 1000 kg. or more per ha. very considerable modifications may take place, as will easily be calculated from Table 1.

⁂

During the last decades a series of methods for determining soil acidity have been elaborated (see especially 1), in which the determinations were made on soil precipitates or filtrates plus concentrated soil solutions. Chloride of potash especially has been used in these determinations. During the last few years, especially in Germany (9), the pH determinations have been made on KCl extracts instead of water, and indeed the KCl method is that principally used there. The author has made enquiries of several investigators as to the preference shown for the KCl method and has generally received the following answers :

1. By the KCl process a clear solution is obtained, but with water turbid extracts are often obtained.

2. By the addition of KCl the maximum results in the soil reaction changes caused by manuring are obtained.

3. By the KCl process constant pH values result.

4. From the values obtained with KCl, information may also be gathered as to the soil's need of lime.

5. By this process (according to KAPPEN, 7) much more important potential acidity is measured.

These points will now be examined :

1. Clearer and better solutions are certainly obtained by the addition of KCl. But the same also happens when acids are added. The objection to the last method for pH determinations is generally understood, but the addition of KCl has also an acidifying effect and should likewise therefore be rejected. What it is desired to ascertain through the pH determination is the actual acidity present in the soil, and this mostly for physiological purposes. By the addition of KCl this acidity is modified ; therefore by the KCl method something quite different from that desired is measured. Unfortunately it is also impossible to transmute the values obtained with the KCl solution by means of a correcting factor into the " water values. "

2. It has been shown that the salt concentrations in the soil obtained by rather abundant manuring are 1/1000 of those which are generally used in these methods (7 % or 1-n KCl). The maximum values, therefore, are never reached, nor even approached.

3. That the values obtained electrometrically after the addition of KCl are more constant than those obtained in soil suspensions in water, is erroneous. By the use of indicators errors with regards to the salts are greatly increased, and especially with methyl-red quite erroneous results are obtained.

4. That the " lime requirement " of the soil can be measured

by the addition of KCl solution seems very improbable. On the one hand we know that as regards soil reaction different plants have quite different tendencies, on the other hand, from tests made, it appears possible to mistake the quantity of lime necessary to convert a soil to a pH unity by determining the titration curve of the soil. If the pH values which are obtained from the three acid soils, are compared before and after the KCl treatment the following is found :

	pH before KCl	After treatment	Difference
Peat	5.25	4.84	0.41
Acid Loam . .	5.05	3.90	1.15
Sand.	5.13	4.16	0.97

According to this it must be concluded that the sand and loam soil have about the same need of lime and the peat much less. From the titration curve it will be seen however that the peat has a much greater lime requirement than the other soils, which is in accordance with the experience of farmers.

5) As shown above, it appears very improbable that potential acidity exists. But it has never been proved that this fact is of any physiological or physico-chemical importance. On the other hand it is clearly shown what a great influence soil reaction has on agriculture (2). It appears to be more important to establish an extremely weighty factor, than to turn one's attention to questions not yet clearly defined and, as it appears, wrongly explained.

⁂

Neutral salt solutions exercise an acidifying influence. It appears as though this influence may be regarded as a neutral salt influence. Ordinary artificial fertilisers exert very little influence in the matter of modifying reactions, on the contrary large additions may even have an unfavourable effect on soil reaction.

Apparently the estimation of soil reactions in salt solutions is an unsatisfactory method.

O. Arrhenius, *Stockholm.*

BIBLIOGRAPHY.

(1) **Arrhenius**, O. Der Kalkbedarf des Bodens vom pflanzenphysiologischen Standpunkt. I. *Zeitschr. f. Pflanzenern. u. Duengung* 1924.

(2) **Arrhenius**, O. Markreaktion och skoerdutbyte. *Medd. Centralanstalten for jordbruksforsoek.* 278. 1924.

(3) **Arrhenius**, O. The potential and actual acidity of soils. IV. Intern. Conf. Soil Science, Rome, 1923

(4) **Amistensen**, H. R og. **Tovborg Jensen**, S. Undersógelser vedrörende elektrometriske metoder til bestemmelse af jordreaktionen. *Tidskr. f. planteavl* 1923.

(5) **Daikuhara**, G Ueber saure Mineralboeden. *Bull. Imp. Centr. Agr Exp. Stn*, 1914

(6) **Freundlich**, H Kapellarchemie, 1923.

(7) **Kappen**, H Ueber die Aziditaetsformen des Bodens und ihre pflanzenphysiologische Bedeutung *Landw Versuchsstat.*, 96, 1920.

(8) **Ackerloef**, G. Die Neutralsalzwirkung bei hoeheren Salzkonzentrationen auf die Verseifungsgeschwindigkeit des Etylacetats und auf die Wasserstoffionenaktivitaet des Katalysators. *Medd K V. A. Nobelinstitut.*

(9) Verh d. Aussch f Boden und Duengung d. Verb. Landw. Versta *Zeitschr. Pflern u Duengung*, 1924.

Abstracts and Literature.

The Aeration of Soils as Influenced by Barometric Pressure Changes.

Bouyoucos, G J and **McCool**, M M. (Michigan Agricultural Experiment Station) *Soil Science*, Vol XVIII, No. 1, pp 53-63, figs 7. Baltimore M., 1924

In the investigation of this problem, the barographs were buried in the earth and the graphs thus obtained were compared with those obtained in the open air. It was found that at a depth of 10 feet the barometric pressure was the same as in the open air, this being the case in all soil types, including even heavy clay. It must be concluded therefore that the air in the soil has free communication with the outside air as far as the impermeable strata.

Calculations then showed that the greater the variations in pressure and the deeper the impermeable strata, the more extensive is the aeration of the soil and the deeper the penetration of the air therein. When on the other hand these factors are slight, the air penetrates to a lesser extent. Considering the whole earth, it must be concluded that the influence of barometric pressure on soil aeration is considerable, especially in the torrid zones; certainly this influence is greater than is generally supposed.

A. F.

Remarks and Observations on Imbibitional Soil Moisture.

FISHER E. A. *Journal of Agric. Science* 14, Part 2, 204-220, 1924.

In previous papers (*Roy. Soc. Proc.* 103 A. 1923, pp. 139 and 164) the author has shown that the evaporation curves of water from wool, sand and kaolin, ball clay, etc., form four straight intersecting lines. The factors determining the shape of the curves depend on the vapour pressure of the water present, the temperature of the drying mass, capillarity and the diminution of the evaporating surface. The first portion of the rate curves can be expressed by the equation $-\frac{dw}{dt} - A = kw$, in which A and k are characteristic constants for each substance. Similar curves were obtained for a deep subsoil containing 55.4 % of clay, yet the section corresponding to the above-mentioned curve sections showed a considerable inclination, for the direction of which the author deduced the equation $-\frac{dw}{dt} - A + a(w - n) - \left[\frac{dw}{dt} - A\right] = kw$. In this equation A, a and k are constants and n the percentage water-content at which the curvature ceased. Curves of the second kind are found only in the case of evaporation curves of materials such as clay soils, which are mixtures of colloidal and non-colloidal substances, for water in colloidal combination evaporates at an approximately constant rate, while the rate of evaporation of the capillary " interstitional " water quickly decreases.

In this paper the manner in which the " imbibitional" water is retained by the soil colloids, as compared with the interstitional or capillary water, is contrasted.

If the critical moisture content, at which the evaporation speed ceases to be constant, be compared with the moisture equivalent determined by the BRIGGS and MCLANE method (*U. S. Dept. of Agric., Bur. of Soils, Bul.* 45, 1907), i. e. that in which the percentage of water in the soil, which remains after the elimination of the water from the capillaries by centrifuging, it will be found that in the absence of colloidal substances, as for instance quartz sand, the moisture equivalent is less than the critical moisture content (the contrary is the case with substances containing colloids). This can only be explained by the fact that the water retained by the clay, or organic matter, as well as by the coating of colloids on the particles of soil acts differently from the moisture retained in the capillaries. According to the tests by PROCTER and his collaborators (*Journal Americ. Chem. Soc.* 40, 886, 1918) the force which causes the entrance of water into a gelatine gel and thus determines the expansion, is the osmotic pressure of the excess of crystalloid-ions inside over that outside the gel; this excess is a consequence of the DONAN equilibrium (*Zeitschr. f. Elektrochem.* 17, 572, 1911). The opposing force, limiting expansion, is the cohesion of the colloidal particles. A gelatin gel expanding through the absorption of water acts as a perfectly elastic body and obeys HOOKE's law : $e - CV$ (V = vol. increase in cc. of 1 mgm equivalent weight gelatine, C = constant corresponding to the modulus of elasticity and e the osmotic foice producing the expansion). In conformity with this law the author found, in his investigations with a saturated wool fabric, which was centrifuged at various speeds, that the moisture content, i e the degree of expansion, is a linear function of the centrifugal force used The tests made by other investigators, for instance those by **Briggs** and **McLane** on the moisture content of soils after centrifuging at a varying number of revolutions, also led to the same results If xylol be used instead of water, the former causing no expansion of cotton, wool, soil, etc, much less xylol than water is retained after centrifuging. This also proved to be the case with soils, as will be shown by a comparison of the moisture and xylol equivalents in the following Table

Moisture equivalents and xylol equivalents of various materials

Material	Moisture equivalent (ME) Dry wt basis (1)	Moisture equivalent (ME) Volume basis	Xylol equivalent (XE) Dry wt basis	Xylol equivalent (XE) Volume basis (2)	ME XE	Max imbibitional water = 1·38 ME	Percentage imbibitional water retained after centrifuging
Kaolin	41 27 40 85 41 1	106 6	33 0	99 4	7 2	147 1	4 9
Ball clay	47 2 45 5 46 3	120 4	20 2	60 9	59 5	166 2	35 8
Silty soil	23 5 22 6 23 0	59 8	8 2	24 7	35 1	82 5	42 5
Clay subsoil	51 0 47 8 49 3	128 2	13 8	41 6	86 6	176 9	49 1

(1) Calculation on basis of real specific gravity of soil = 2.60

(2) Calculation on basis of real specific gravity of soil = 2 60 and specific gravity of xylol = 0 863

The differences between the moisture equivalents and the xylol equivalents probably furnish a standard for the imbibitional water absorbed by the colloids, as distinct from the interstitial liquid In kaolin, possessing, as is known, but few or no colloidal properties the moisture and xylol equivalents, on a volume basis are almost the same This indicates that water, like xylol, is retained interstitially, and that little or no water is held by imbibition In the other three tests the imbibition and consequent expansion is considerable, and much greater with the clay subsoil than with the ball clay. **Berju.**

Capillary Distribution of Moisture in Soil Columns of small Cross Section.

McLaunglin, W W (Bureau of Public Roads) *United States Department of Agriculture Department Bulletin* No 1221, p 22, Fig 7 Washington, D C, 1924

The author carried out experiments for the purpose of ascertaining the distribution of capillary moisture in vertical, horizontal and inclined soil columns. Different kind of soils were used, distributed evenly and uniformly into 32-38 mm. pipes. Capillary moisture did not decrease or increase in relation to proximity to the water level. The highest percentage of moisture was not found close to the water level, but at some distance from it. The chart recording the percentage of moisture present in the soil columns shows an irregular curve, the ends of which, corresponding to the top of the column, form almost a straight line.

In all the experiments carried out, except in a test on the silty sand of Idaho, the quantity of water found in the lower half of the pipes was greater than the average content of the entire soil column. A moderate content of water was present from the half of the soil to $^2/_3$ of its height while the greatest quantity existed at a height varying from $^1/_7$ to $^1/_5$ of the immersed portions of the column. In all the soil columns the same percentage of moisture existed at a distance of a few inches from the level of the water. The different methods of cultivating the soil and of aeration caused no alteration in the moisture content.

In the horizontal soil columns, with a vertical line of 100 m/m to the horizontal surface, it is observed that the highest degree of moisture is generally, though not necessarily, present at the further end of the pipe, in close proximity to the water. A moderate percentage exists at a distance from the water equal to half the length of the pipe ; its distribution alters when the water reaches the outer end. In columns that are inclined towards the base, the highest percentage is present at the top of the pipe when the force of gravity and capillarity act simultaneously. The total quantity of moisture contained is a good deal less than the capillary saturation. If the flow towards the base is stopped by an impervious layer, the content of moisture above this is equal to that observed in a vertical soil column with the water level at the surface of this layer.

A. F.

The Theory of the Mechanical Analysis of Sediments by means of the Automatic Balance.

FISHER R A, and ODEN, Prof. SVEN. *Proceedings of the Royal Society of Edinburgh*, Vol. XLIV, Part 2. pp. 99-115 Edinburgh

In 1916, in a paper on the size of the particles in deep-sea deposits, Odén showed that the distribution by mass of a suspension into classes of particles of different size, could be inferred from a study of the course of sedimentation of such a suspension from a state of uniform dispersion in water.

In the article now published, the authors have set forth, in a more complete form than has hitherto been attempted, the theory of the derivation of the distribution curve and the statistical methods appropriate for its deduction from the physical data.

A summary of the conclusions drawn is as follows :

(1) A simplified mathematical statement of the theory of sedimentation through a stationary fluid, leads to the formula indicated by Odén,

and shows that the characteristic distribution of the sediment may be obtained:

(*a*) from the variation of density with depth;
(*b*) from the rate of change of density at a given depth;
(*c*) from the variation of hydrostatic pressure with depth;
(*d*) from the rate of change of hydrostatic pressure at a given depth.

The last relationship affords the theoretical basis of the sedimentation method.

(2) Schloesing's sedimentation is incomplete, and leads to errors.

(3) Statistical problems arise in the reduction of sedimentation data derived from the automatic balance, and data from two duplicate experiments are utilised to examine into the experimental errors actually present.

(4) Two types of fluid motion appear to influence results:

(*a*) A vertical circulation set up by the initial disturbance of the fluid. This may be remedied by using fluids of higher viscosity.

(*b*) Convection currents of unspecified type will become important in prolonged experiments, where the finer particles are being studied. Great experimental refinement may be necessary to avoid these; their effect should be reduced by maintaining the temperature of the water as close as possible to its temperature of maximum density.

W. S. G.

Investigations on the Rate of Outflow of Granular Substances.

G. SCHULTZ ZUR OVEN. Untersuchungen über das Ausfliessen von Körnungen

LANGHANS, in his investigations on the angle of inclination (*Kolloid Zeitschrift*, Vol. XXVIII, 3), found that each powder or granular substance has a characteristic angle of inclination, and recommends the determination of this angle for the identification of food-stuffs, powders, etc. According to LANGHANS the angle of inclination depends on the specific gravity, friction coefficient and size of grain of the substance. According to BOUSSINESQ (*Beibl. z. d. Annalen*, Vol. 6, 1919), the flow of the sand through an hour-glass, with a suitable size of grain, depends on the form and dimensions of the vessel, not on the height of the sand itself. For a number of substances: kaoline, sand, loam, loess, chalk, clay, slate, corundum, glass, I have accurately tested the flow through suitable vessels, in order to determine the importance, as affecting the outflow of the particles, of the specific gravity, size of grain, form and nature of the surface of the particles, and the shape of the vessels. For the tables, illustrations, graphs and full text, see my Dissertation, Giessen, 1912.

The following is a summary of the results:

(1) The specific weight has no decisive influence on the outflow of dry particles.

(2) The speed of the outflow does not depend on the height of the material in the vessel.

(3) It is however dependent on the shape of the vessel, on the size of

the grain of the same material, on the shape of the particles and the nature of their surface; for speed of the outflow of the different fractions of the same substance there is an optimum. AUTHOR.

A Note on Soil Shrinkage.

E. A. FISHER. *Journal of Agric. Science*, 14. 126-132, 1924.

A critical review of W. B. HAINE'S theory on the progress of soil shrinkage after the drying of the soil (*Journal of Agric. Science* 13, 296). From the results of this investigation the importance of the critical water content, i. e. the water content at which rapid evaporation ceases to be constant, and the divergence between the lower part of the moisture curve and the corresponding part of the vapour pressure curve, can for the first time be accurately defined. BERJU.

Method for Determining the Permeability of Colloid-Dispersing Substances under the Influence of Electrolytes.

G. SCHULTZ ZUR OVEN Methodisches zur Untersuchung der Durchlaessigkeit Kolloiddisperser Substanzen unter der Einwirkung von Elektrolyten.

The apparatus used by HISSINK for determining the permeability of the soil under the influence of various salt solutions (*Int. Mitt. für Bodenkunde* Vol. 6, 1916) does not sufficiently prevent the escape of the colloid-dispersing particles. In the method used by the writer, both the utility of a porcelain filter and also that of DE HAEN'S membrane filter were tested, and it was found that a certain type of membrane filter does not allow the dispersing particles to pass through, so that it is possible to work on a large scale with these " ultra " filters (1). Reference should here be made to a work by W. WENSE, the expert in filtration technique (*Zeitschrift für angewandte Chemie* 1923, No. 47-8, pt. 310), in which the difficulties and inconveniences often arising in the filtration of highly dispersive suspensions are mentioned, and effective measures of precaution and practical hints given.

The use of a high suction pressure increases the rate of filtration, but even then a slackening of speed very soon takes place. The use of tubes over the membrane gives but slight results and of short duration ; the use of a broad, soft brush, with which from time to time the " obstructing layers " may be removed from the membrane, and perhaps also particles blocking the pores, proved to be more effective ; but even then the advantage gained is not great. On the other hand, the cleaning of the pores by driving a current of air and water through them was quite effective. The advantage gained through the water current was, however, due to the increased volume of water passing over the membrane, partly negatived as regards the total duration of filtration. The greatest rate was attained by a regular alternation between filtration and air-current. The conveniently placed taps on the apparatus made possible very accurate and effective working.

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(1) More detailed information may be had from the writer's dissertation (Giessen, 1921).

The local conditions of soils are due to the varying dispersion of the soil colloids. Granulation, i. e., the formation of the larger soil particles is largely dependent on the nature of the electrolyte with which coagulation is effected. In suspensions of colloidal soil particles, as well as in Berlin-blue sol, the rate of filtration proved to be dependent on :

(1) The degree of dispersion. — With increasing sedimentation the speed decreased; the hydrostatic level played a subordinate part in this connection.

(2) The electric chargeability of the dispersed particles. — It was important first to determine the chargeability of the dispersum before commencing the test, or, as is easily possible with Berlin blue, to produce a clearly defined electric material. The differences in the series of tests with positive and negative electric material are very great, as will be seen from the graphs and the sedimentation determinations made on the interruption of the experiment.

There are no essential differences between sol and gel as regards the influence of the electrolyte.

The variation in dispersion brought about in the sol does not cease in the gel, so that here it is a case of a merging of the series of phenomena into one another, it being assumed that the optimum of the structural change had not yet been reached in the sol.

A structural change in colloidal systems is adopted in agriculture when, for instance, it is necessary to lime a soil. Here the absence or presence of soil acidity, as tests with acid and neutral loess have shown, plays a prominent part. The degree of soil dispersion is heightened by potash ions, for calcium ions are supplanted by them and the soil cakes over. This interchange of bases is reversible.

(3) The influence of the electrolyte concentration. Until expansion takes place the size of the coagulated particles is largely dependent on the electrolytic concentration, but this influence appears to be of secondary importance.

(4) The nature of the electrolytes. Both cations and anions come into action during the coagulation; the cations appear to have the greatest influence. The diminishing influence of the electrolytes on the dispersion phase is dependent on the chargeability of the dispersum and very particularly on the atomicity of the electrolytes. AUTHOR.

Investigations on Alkali Soil and Colloidal Phenomena.

JOFFE, J. S. and MCLEAN, H. C (New Jersey Experiment Station). *Soil Science*, Vol. XVII, No 5, pp. 395-409, figs 2. Baltimore, Md., 1924.

The work hitherto done on soil alkalis had a purely practical scope and and was based on empiricism. Only in recent times in Russia has a series of investigations to discover the origin of soil alkalis and reaction been begun. Such knowledge is necessary before undertaking any scientific treatment. An important feature of the recent investigations is the estimation of the colloidal nature of some phenomena inherent in soil alkalis. The following conclusions may be drawn from the authors' investigations. The positive and negative absorption of the soil and soil solution system is of great importance for the washing out of the soluble substances. A negative absorption is desirable in alkaline soils. The coagulation of the colloids increases the surface tension of the extract and modifies the physical conditions of alkaline soils, which modifications show themselves by the capillary ascent of the water and the soil's permeability to water. In the investigations on the effects of alum and sulphuric acid on the coagulation of the alkali soil colloids, the authors have observed that the combined effect of both such substances is greater than that of either of them separately. At pH 4.7, coagulation is almost instantaneous, which indicates that this is probably the isoelectrical point. The alkaline soil colloids are charged negatively and then precipitated from the colloids with a positive charge, or by electrolytes with high-power cations. The dispersal phase which affects the surface, influences evaporation; the vapour pressure of the extracts undergoes little alteration from the various treatments.

In normal soils, the colloids serve to retain various constituents and therefore delay washing out; in alkaline soils, this colloidal property reduces the permeability and aeration of the soil and increases its power of retaining substances, thus bringing about the accumulation of the salts after dessication.

A. F.

Soil Climatic Conditions and Clay Silicates.

GANSSEN R. (Gans.) (Die Klimatischen Bodenbedingungen der Tonerdesilikatgesteine). *Mitteilungen aus den Laboratorien der Preussischen Geologischen Landesanstalt* part 4, pp 32 Berlin, 1922 (Published by the Preussischen Geologischen Landesanstalt, Berlin. No 4. Invalidenstrasse 44).

In this work the author discusses the decomposition of clay silicates. Three kinds of weathering are described:

(1) the weathering of clay;
(2) the weathering of laterite;
(3) weathering by hydration.

The author describes in detail the methods for determining the various types of decomposition, and then discusses the chemical processes which take place in connection therewith.

(1) The weathering of clay in moist, cool and temperate zones:

$$x\,\underbrace{(6\,SiO_2\,.\,Al_2O_3\;K_2O)}_{\text{(potash feldspar)}} + x\,H_2O = 4 - \underbrace{6\,SiO_2\,.\,Al_2O_3\,.\,K_2O\,.\,m\,H_2O}_{\text{(zeolitic silicate)}} + \underbrace{2\,SiO_2\,.\,Al_2O_3\;2\,H_2O}_{\text{(kaolin silicate)}} + 3 - \underbrace{6\,SiO_2\,.\,K_2O\,.\,n\,H_2O}_{\text{(soluble potash silicate, eliminated in partly clear, partly colloidal solution).}}$$

(2) The lateritic or clay-lateritic decomposition in semi-moist, torrid, and temperate zones:

(*a*) purely lateritic decompositions:

$$\underbrace{6\,\mathrm{SiO_2 \,.\, Al_2O_3\, K_2O}}_{\text{(feldspar)}} + x\,\mathrm{H_2O} = \text{(primary process)}\ \underbrace{6\,\mathrm{SiO_2 \,.\, Al_2O_3 \,.\, K_2O} \,.\, m\,\mathrm{H_2O}}_{\text{(zeolitic silicate)}} + y\,\mathrm{H_2O}$$

$$= \text{(secondary process)}\ \underbrace{\mathrm{Al_2O_3 \,.\, 3\,H_2O}}_{\text{(hydrargillite)}} - \underbrace{6\,\mathrm{SiO_2 \,.\, K_2O} \,.\, n\,\mathrm{H_2O}}_{\text{(soluble silicate, eliminated)}}$$

(*b*) clay lateritic decomposition:

$$\underbrace{6\,\mathrm{SiO_2 \,.\, Al_2O_3 \,.\, K_2O} + x\,\mathrm{H_2O}}_{\text{(feldspar)}} = \left\{\begin{array}{c} \textit{primary process} \\ 4\text{-}6\,\mathrm{SiO_2 \,.\, Al_2O_3 \,.\, K_2O} \,.\, n\,\mathrm{H_2O} \\ \text{(zeolitic silicate)} \\ \\ + 2\,\mathrm{SiO_2 \,.\, Al_2O_3 \,.\, 2\,H_2O} \\ \text{(kaolin silicate, unchanged by} \\ \text{further influence of water).} \end{array}\right. \begin{array}{c} \\ \leftrightarrow \\ \\ + y\,\mathrm{H_2O} = \\ \leftrightarrow \\ \\ \end{array} \left\{\begin{array}{l} \textit{(secondary process)} \\ \mathrm{Al_2O_3 \,.\, 3H_2O}\ \text{(Hydrargillite)} \\ 4\text{-}6\,\mathrm{SiO_2 \,.\, K_2O} \,,\, n\,\mathrm{H_2O}\ \text{(soluble} \\ \text{silicates liberated).} \\ + 2\,\mathrm{SiO_2 \,.\, Al_2O_3 \,.\, 2\,H_2O}\ \text{(kaolin} \\ \text{silicate, unchanged in se-} \\ \text{condary process).} \end{array}\right.$$

(3) Decomposition by hydration in arid and semi-arid zones:

$$\underbrace{6\,\mathrm{SiO_2 \,.\, Al_2O_3 \,.\, K_2O}}_{\text{(feldspar)}} + x\,\mathrm{H_2O} = \underbrace{6\,\mathrm{SiO_2 \,.\, Al_2O_3 \,.\, K_2O} \,.\, n\,\mathrm{H_2O}}_{\text{(zeolitic silicate)}}.$$

In addition to the factors of heat, precipitation and evaporation, the effect is discussed of the composition of the underlying rock on the type of decomposition, and the reaction of the resulting soil.

H. HALLER.

Soil Reaction in Relation to Calcium Adsorption.

SWANSON, C O (Kansas Agricultural College) *Journal of Agricultural Research*, Vol. XXVI, No 3, pp. 83-123, figs. 7, tab. 23. Washington, D C., 1923.

The author observes that acid soil reaction is not determined by organic substances. Indeed, the pH values are the same before and after soil burning; further, a certain quantity of oxalic acid may be added to the soil without changing H-ion concentration. The addition of a slightly ionized acid, on the contrary, heightens CH-ion concentration, probably through the formation of salts of a weak acid with a strong base.

The cause of acid soil reaction should be looked for instead in chemical phenomena connected with the climatic factors which lead to soil formation. There is more probability of its acidity when the yearly rainfall is in excess of evaporation, whereas when the contrary is the case there is a tendancy to alkalinity. The cause of the acidity is to be looked for therefore in the carrying off of the bases, and especially of calcium, which takes place in the decomposition of the silicates. Under such conditions vegetation languishes since calcium is necessary to plant growth and development. The addition of calcium, in the form of Ca $(OH)_2$ to such soils tends to reestablish the former conditions. In these processes it is a question of adsorption more than of chemical combination.

It may therefore be concluded that the presence of aluminium silicate brought about by the influence of climatic factors, causes the adsorption of the calcium of Ca $(OH)_2$ and $CaCO_3$. The washing out and treating with acids, which may be considered as an exaggeration of climatic factors, increases the soil's power of adsorption. The latter is therefore dependent on the aluminium silicates which are formed in such processes and may be considered as a phenomenon of base substitution. The adsorptive power of aluminium silicates is greater for calcium than potassium. A. F.

On the Measurement of the Hydrogen-ion Concentrations in Soil by means of the Quinhydrone Electrode.

BIILMANN EINAR. *Journal of Agricultural Science*, 14, 232-39, 1914. (Compare CHRISTENSEN and HARALD, *Intern. Mitteilungen für Bodenkunde*, 14, p. 2. 1924).

Hydrogen-ion Concentration in Soil and Lime Requirement.

JONES, J. S (Oregon Experimental Station) *Soil Science*, Vol XVIII, No 1. pp. 65-74, bibliography Baltimore, Md , 1924

Crops are possible within certain limits of hydrogen-ion concentration, beyond which, however, the soil must be improved in order to bring it to the necessary concentration. Such investigations, however, though important, are generally neglected in the examination of soil. The author has made this determination on many soils, using the colorimetric method, which has given results in accord with the electrometric method, and has compared the values thus obtained with the lime requirement of soils.

Generally, if the hydrogen-ion concentration varies considerably in the same soil type, with the exception of two or three samples, which represent perhaps the extreme types, there is a remarkable uniformity in all the others. Alfalfa and clover crops may succeed well within rather wide limits of hydrogen-ion concentration. There is no relation therefore between this and lime requirement. A. F.

Investigations on Soil Minerals and their position in the Speier Stratum and Soils of the Kusel Beds as shown on the Geological Map (1 : 100,000).

(Untersuchungen ueber Böden Gesteine und ihre Lagerung im Blatt Speyer und Böden im Blatt Kusel der geologischen Karte 1 : 100 000). *Geognostische Jahreshefte* 35th Year, Munich, 1923.

In the previous Palatinate number of the Bavarian Geological and Agricultural Institute an important place is assigned to soil science investigations. OTTO M. REIS writes at length on the stratification and geological character of the various alluvial, loess, tertiary, coloured sandstone, shell-lime and lower red sandstone soils, while H. NIKLAS and A. HOCK treat of the soil reaction and need of lime of the Speier beds. H. NIKLAS shows, from the results of investigations, that the soil reaction is more or less influenced by the geological structure, while OTTO M. NEIS is of opinion that soil acidity is not so much caused by the formation, the most important factor being the presence or absence of a forest growth, or the fact that it was a forest soil in a not distant past. Indeed, a soil becomes acid not in consequence of its petrological character, but through the influence of the plants which cover it, or the agricultural uses to which it has been put.

In comparing the different methods for testing soil reaction and its need of lime, many interesting facts come to light. Thus, as NIKLAS says, the need of lime does not depend on the existing quantity of lime, but on the buffer action of the soil, and what reaction it causes. The alluvial and loess-loam soils show the least hydrogen-ion concentration. Bunter sandstone and lower red sandstone, on the other hand, prove, in all the tests, to be acid. From the total acidity estimated by titration with $^1/_{10}$ N. alkaline soda solution, the quantity of lime necessary to neutralise the acidity was estimated, and thus the lime requirement of the field was determined The titration of the soil acidity by DAIKUHARA's method gave no reliable values, for the iron and especially the aluminium hydroxide, formed colloidal compounds with the acid, which escaped titration. Neutral soils require a particularly searching test as regards their lime requirement. In CHRISTENSEN's azotobacter test, the five-days' treatment is decidedly preferable to the three days' treatment, as was shown by the tests.

While the upper red sandstone soils in the Speier beds tested by NIKLAS are really all acid, there are, in the lower red sandstone of the Lautertal, between Olsbruecken and Wolfstein (Kusel beds), according to OTTO M. REIS, also alkaline soils near those which are acid. But the $CaCO_3$ content, determined by PASSON's method, was negative everywhere, and only once was a trace found of $CaCO_3$. In spite of this, the percentage of CaO content can be estimated at 0 41 %. These results show how carefully PASSON's lime test should be used. The only acid soil among the samples with 0 05 % CaO was taken from forest land.

Field crops, as is well-known, except on soil of the most marked lime formation, imply no surety against acidity, especially when physiologically acid artificial fertilisers are used.

HERM. FISCHER.

Importance of Hydrogen-ion Concentration in Physico-Chemical Studies of Hevea Soils.

BRADFIELD, R (Agricultural Experiment Station, University of Missouri). *Soil Science*, Vol. XVII, No. 5, pp. 411-422, Fig. 6, bibliography. Baltimore, Md., 1924.

The author in this article discusses the flocculation of clay and the effect of hydrogen-ion concentration upon the absorption and exchange of bases. The importance of this in a physico-chemical study of soils is pointed out and its practical results. A. F.

Changes in the Chemical Composition of Soils in Cylinders after long continued Treatment.

BLAIR, A. W. and PRINCE, A L. (New Jersey Agricultural Experiment Station). *Soil Science*, Vol XVIII, No. 1, pp. 31-32. bibliography. Baltimore, Md., 1924.

The chemical composition of the soil continually changes, but our methods of investigation are not sufficiently delicate to follow such changes unless the determinations are made continuously over a long period of years.

The authors have investigated the problem with the cylinder method, already described in Bulletins Nos. 221 and 288 of the New Jersey Agricultural Experiment Station. The investigations covered a period of 25 years, various fertilising treatments being applied and both the soil and the crop analysed.

Phosphoric anhydride. — The quantity present in the soil, plus that carried away by the crop, is rather less than that generally present in the soil plus that added by fertilising. Supposing the fertiliser contains 100 lb. per acre, the loss is 13 lb. per acre. By doubling the addition of phosphoric anhydride, a larger crop is obtained, but the loss is three times greater. It must be concluded that the phosphoric anhydride is carried away by drainage water. When this fertiliser is applied in large quantities it may accumulate in the soil, which may be injurious.

Potash There is generally a loss, notwithstanding applications of potash. Soils containing 2.6 % at the outset only contained 2 % at the end of the test. The loss was caused through the crops and the drainage water; the more abundant the fertilising in general, the greater is the loss under both these heads.

Lime. In the cylinders in which lime was not added, a decrease of the latter was observed; the loss was greater in that in which sulphate of ammonia only, without lime or farmyard manure, was used. With few exceptions, the cylinders in which lime was added showed an increase of the latter.

Magnesium. It was not applied as a fertiliser, but only added as a lime impurity and with farmyard manure. A decrease of from 2.24 % to 1.5 % was noticed.

Reaction. The soils in all the cylinders where lime was not added became acid. The lime requirement is reckoned at from 1400 to 2800 lbs. per acre; the pH value varied from 4.9 to 6.2 %. The cylinders in which lime had been added, on the other hand, showed no need of lime; their pH was from 6.5 to 7.3. The continued use of acid phosphates did not cause acidity.

Among the cylinders where lime had not been added, the greatest need of this was observed in that treated with sulphate of ammonia only; the soil became so toxic that not a single plant reached maturity.

A. F.

Comparison of the Soil Solution by Displacement Method and the Water Extract of Alkali Soils.

HIBBARD, P. L. (University of California, Agricultural Experiment Station). *Soil Science*, Vol. XVI, No. 6, pp. 465-471, bibliography. Baltimore, Md., 1923.

Two methods in use for the analysis of the soluble elements of soil are:— the " Solution ", obtained by the displacement method, and the " Extract ", obtained by mixing with the soil a quantity of distilled water almost entirely free from CO^2, equal to five times its weight, after which, the Pasteur filter is used. Experiments carried out by the author indicate that the water extract does not represent the actual conditions in the soil, as the figures recorded for carbonate, bicarbonate and phosphate are higher than those actually existing. The data registered for chlorine, sodium and nitrate are approximately correct; sulphate and potassium show an excess, while the data given for calcium and magnesia may be either too high or too low. The geo-chemical classification shows that the water extracts contain a relatively higher proportion of sodium salts, whereas calcium and magnesium salts are less abundant than in the real solution. The latter makes the soil appear more suitable for the growth of plants than does the water extract method. A. F.

The Rapid Determination of Available Phosphate in Soil by the Coeruleo-Molybdate Reaction of Denigès.

ATKINS W. R. G. *Journal of Agric. Science* 14, Part 2, 192-197, 1924.

In determining the P_2O_5 in saturated soil extracts, 10 gm. of air-dried soil, which had been passed through a 100-mesh sieve, were shaken with 50 cc. of water, 10 cc. of the extract being centrifuged until clear, and 5 cc. of this extract was made up to 100 cc. and reduced by the following reagents: (Reagent A) 100 cc. 10% ammonium molybdate + 300 cc. 50 per cent by volume, H_2SO_4. (Reagent B) 0.1 gm. tin after the addition of one drop of a 4 % copper sulphate solution, was dissolved by 2 cc. pure HCl, and after solution of the Sn the whole was made up to 10 cc. For every 100 cc. of the extract prepared as above 2 cc. of reagent A, and 5 drops of reagent B (which must be freshly prepared every day) were added. With a similar quantity of these reagents a control solution was prepared containing 0.05 or in some cases 0.5 mg. of P_2O_5. After the addition of the reagents the solution assumed a blue colour, which attained its maximum intensity after 5 minutes. The colorimetric tests can be made in a simple manner in 100 cc. HEHNER cylinders. Faults through slightly coloured extracts, which impart a green colour to the blue solution, can be corrected by the addition of a few drops of a dilute solution of Bismark brown to the test solution. The method allows the P_2O_5 in the soil extract (1 : 5) to be determined even after considerable dilution. High phosphate contents were found in the samples taken from bog peats. In the majority of the soils examined, less than 2 parts of water-soluble P_2O_5 were contained in 1 million parts of soil. Manured soils contained

20 or more parts. A 3-4 hours' extraction gives the same P_2O_5 content in ordinary soils with a low P_2O_5 content, as a 4-7 days' extraction. In soils rich in P_2O_5 on the other hand, the solubility of the P_2O_5 appears to be retarded by lengthened extraction and may undergo reversion to an insoluble form during prolonged extraction.

BERJU.

The Determination of Nitrates in Soils.

HARPER, HORACE J (University of Wisconsin, Madison, Wis.). *Industrial and Engineering Chemistry* Vol 10, No 2, pp 180-183 Washington, D C

Among the various methods proposed for the determination of nitrates in soils, that of phenoldisulphonic acid is most used because it is the simplest and quickest. It presents various difficulties however: (1) that of obtaining a perfectly clear and colourless extract, which is absolutely essential; (2) of obviating the losses in nitrate which occur, from various causes, during the determination; (3) of making an exact comparison between the sample solution, of known value, and the solution under examination, avoiding the use of reagents which interfere with the process.

In these notes the Author reports an accurate analytical process for obviating this difficulty, which ensures the most exact results being obtained. To obtain a perfectly clear and colourless extract, the Author, basing on practical tests repeatedly made on different types of soil, suggests as most suitable in all cases, the use of the sulphate and hydroxide of copper, which serve as excellent colorising and clarifying agents The losses in nitrates during the determination process, as has already been observed by other-experimentalists, chiefly takes place: (1) *through absorption* by certain decolorising and clarifying agents (e. g. the various kinds of decolorising carbons, aluminium hydroxide, etc); (2) *through evaporation* when the extract obtained and which evaporates is acid, (3) through the presence of other salts in the extract, such as carbonates and chlorides, the latter only if found in the soil in quantities of more than 15 parts per million. To reduce to a minimum this loss in nitrates the Author proposes : to use copper hydroxide as a decoloriser, bring that portion of the extract which is to be evaporated to a distinctly alkaline reaction, and if necessary, set free the chlorides, precipitating with silver sulphate, and finally, when evaporation has taken place, add to the dry precipitate obtained 3 cc. of phenoldisulphonic acid in such a way that the whole of the precipitate, from the centre to the periphery, is completely saturated by the reacting agent. The presence of colorisations, which prevent an exact comparison being made between the nitrate solutions of known value serving as controls, and the solution under examination, is due either to the presence of organic substances or of insoluble salts in the precipitate, or to an irregular use of the various reacting agents.

By using copper hydroxide the colorisation due to organic substances is absolutely excluded. As to the other causes, to obviate them it suffices to follow out the process exactly.

L. M.

Iron, Aluminium and Manganese in Hawaiian Soils,

McGEORGE, W T. (Experiment Station, Hawaiian Sugar Planters' Association) *Soil Science* Vol XVIII, No 1, pp 1-2, bibliography. Baltimore, Md, 1924

Until now, the presence of free acids in soils has been considered the cause of their poor fertility. As a matter of fact, in the Hawaiian Islands, poor vitality in the roots of the sugar-cane and pineapple, the principal local products, has been met with in the highly acid soils This however is associated with abundant quantities of soluble salts of iron and aluminium while on the other hand it has been found that the toxicity of certain acid soils must be attributed more to the presence of soluble salts of aluminium and manganese than to hydrogen-ion concentration The principal characteristic of the Hawaiian soils, like many others of the acid type, is the absence of easily soluble salts of lime and magnesium and of soluble phosphates Hence there is an accumulation of acid salts of iron, aluminium, manganese and of hydrogen-ions liberated by hydrolysis

Soluble crystalloid salts of iron, manganese and aluminium were as a matter of fact found in soils with pH values below 5 8 With more than 6 0 pH, manganese is absent from the soil solutions, and iron and aluminium are only found therein as hydrosols of the hydrates of iron and aluminium.

The solubility of manganese as found by COMBER's test, is due to the greater hydrogen-ion concentration, obtained by treating the soil with sulphocyanate of alcoholic potassium The solution of normal nitrate of potassium does not liberate the aluminium from the silicates, except in soils with less than 6 0 pH A F

The Electrical Conductivity of Extracts from Soils of various Types, and its Use in Detecting Infertility.

ATKINS W R. G. *Journal of Agric Science* 14, Part 2, 198-203, 1924.

In determining the electrical conductivity of diluted soil extracts, 10 gm. of air-dried and sifted soil extract were diluted with 50 cc of water, shaken and tested until there was no longer any appreciable alteration of the conductivity. In alkali soils, which showed the greatest conductivity, this took place after 6-14 days in soils with a slight salt content, and much sooner in peat soils, which showed a high conductivity. Acid soils generally showed but slight conductivity, which mostly reached its maximum after a short treatment.

Though a high salt concentration in the extract is no sure sign of soil fertility, it may however be concluded from the fertility data and the results of the tests, that the fertility is generally low in the case of such soils which exhibit very slight conductivity and show but little concentration of their liberated salts. On the other hand a high electrical conductivity of the soil extract may only indicate the presence of large quantities of liberated salts, and is not always necessarily a sure indication of the fertility of the soils in question. A rapid increase of conductivity in diluted extracts indicates on the other hand an increased liberation of salts, which

is partly effected by bacterial action and may therefore be taken as a useful criterion in judging fertility. Low conductivity, which after long-continued extraction persists, indicates that the soil is infertile.

Berju.

Studies on Virgin and Depleted Soils.

Millar, C. E. (Wisconsin Agricultural Experiment Station). *Soil Science*, Vol. XVI, No. 6, pp. 432-448, bibliography. Baltimore, Md. 1923.

The greatest degree of solubility is found in virgin soils, as measured by the freezing-point method. Results of experiments continually proved this fact, which indicates that solubility gradually diminishes and forms an important factor in the transformation from virgin to depleted soils.

Generally speaking, solubility is apparent in lesser degree in the lower layers of soil than in those at the surface , it is also greater in the lower layers of depleted soil than in the same layers of virgin soil. This tends to show that the greater number of crop plants absorb nourishment from the surface or ploughed layers.

Cropped soils yield a greater quantity of sulphates, while virgin soils gave larger quantities of iron, aluminium, calcium and magnesium.

The proportion in which various constituent matters are given up by soils is an important factor in determining their crop producing capacity.

A. F.

The Soil Organic Matter and Accessory Substances promoting Plant Growth.

Clark N A. (Department of Chemistry, Iowa State College, Ames, Ia). *Industrial and Engineering Chemistry*, Vol 16, No 3, pp 249-250. Washington, D. C., 1924 (1)

The influence of soil organic matter on growth has been investigated from two points of view: its direct and its indirect influence.

Greater attention has been paid by the various investigators to its indirect influence. Its direct influence, which may be nutritive, toxic or accessory, is more difficult to investigate, but is very important.

The author cites, among those who have investigated the direct influence of soil organic matter on plants, the names of Schreiner and Shorey, who in 1910-1912 carried out systematic investigations and isolated a certain number of compositions in a pure state. Some of these compositions, as for instance picolin carbosilic acid, had a decidedly toxic effect on corn, when added to a nutritive solution. Others, such as histidin, were beneficial, and some had no influence.

Knudson and Cornell proved that sugar can be assimilated by maize and legumes and Livingston pointed out the efficacy of small quantities of organic substance, added to nutritive solutions, on the growth of maize.

The possibility of some soil organic substances influencing the growth of green plants has been especially laid stress on by BOTTOMLEY in England. He even went so far as to admit that the addition of small quantities of organic substances, extracted from the soil, to the mineral nutritive element is absolutely essential to the life and reproduction of green plants. He gave the name of " auximones " to these accessory substances, and considered them analogous to vitamines.

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(1) See also *R.* 1924. No. 506. *(Ed.)*

The author continues by observing that it now seems an established fact that small quantities of organic substances influence the growth of green plants, but there are still doubts as to the nature of this influence. The question should be considered from two points of view: (1) these accessory substances are analogous to vitamines; (2) these accessory substances only accelerate growth.

The first point has been thoroughly investigated in the author's laboratory. It had to be proved whether green plants can or cannot live and reproduce themselves in the absence of these substances. The tests were especially made on *Lemna major* and *Lemna minor*, acquatic plants already examined by BOTTOMLEY.

Tests were made with various nutritive solutions. In DETMER and KNOP's saline solution, without the addition of any organic matter, these plants live with difficulty, whereas on adding a small quantity of organic matter they show vigorous development and normal reproduction. The mineral salts contained in the solutions were evidently not suitable for the plants in question. In other tests, the Author, by making use of the three salts first proposed by LIVINGSTON (monocalcium phosphate, potassium nitrate and magnesium sulphate) in proper concentrations, succeeded in making *Lemna major* grow normally without any addition of organic matter. The tests prove that these accessory substances cannot be considered as essential to the life of green plants, as are vitamines to that of animals. The author concludes by saying that other investigations are being made in his laboratory with a view to finding out whether these accessory substances on the other hand accelerate plant growth.

L. M.

Influence of Organic Matter upon the Development of Fungi, Actinomycetes and Bacteria in the Soil.

WAKSMAN, S. A. and STARKEY, R. L. (New Jersey Agricultural Experiment Stations). *Soil Science*, Vol XVII, No. 5, pp. 373-378. Baltimore, 1924.

It has already been noted that the addition of organic matter to soil greatly increases the number of micro-organisms. The authors have systematically studied this phenomenon, making use of various organic matters, and estimating the quantity of micro-organisms by means of the plate method. It has been shown that all organic matter used greatly increases the number of micro-organisms, but not all to the same extent. The action of dextrose is to increase especially the number of bacteria; cellulose, increases fungi; rye straw and alfalfa meal favour both bacteria and fungi; dried blood increases fungi, bacteria and actinomycetes. The addition of nitrate of sodium to the straw treated soil, increases the number of fungi, without altering that of bacteria; alfalfa increases the number of organisms more effectively than straw, and blood acts still more strongly. The number of fungi increase more in acid soils than in those where the reaction is almost neutral. The numbers of organisms reach a higher point in fertile soils than in less fertile soils. These observations confirm the work done by other investigators, according to whom bacteria thrive most on the dextrose, while fungi mostly develop on cellulose, pentose and other complex carbohydrates.

The majority of bacteria require less nitrogen than do fungi, which require it for building up their mycelia. Cellulose is not attacked by most soil bacteria but is rapidly acted upon by numerous kinds of soil fungi, for this however the presence of nitrogen is required. A. F.

Study of Microbic Flora in Soil.

MARTIN, T. L. (Brigham Young University). *Soil Science*, Vol. XVI, No.6, pp. 475-477. Baltimore, Md 1923.

The author in his experiments used as green manure rye, oats and buckwheat harvested at three different stages of growth, and made careful observation of the effect on the various microorganisms of the soil. It was shown that non-spore-formers are in a majority in normal soil. The addition of green manures increases the number of the micro-organisms. The fresher the manure the larger the number of actinomycetes as compared with other organisms, there is also less effect on spore-forming organisms.

It would seem therefore that the actinomycetes form a special factor in the decomposition of cellulose

It is probable that a study of the effects of the various treatments of soil and their relation to various microorganisms, will supply useful data and thus lead to better knowledge of the different soil phenomena.

A. F.

Nitrogen Fixation in Soil and Mannite Decomposition.

WAKSMAN, S. A, and KARUNAKAR, P. D (New Jersey Agricultural Experiment Stations). *Soil Science*, Vol. XVII, No. 5, pp. 379-393, Fig. 3, Bibliography. Baltimore, Md, 1924.

There is a definite relation between nitrogen fixation of soil and soil productivity as well as between productivity and other bacterial activities. The presence of an excess of available carbohydrates, such as mannite will further the growth of microorganisms which will decompose the mannite and obtain the necessary nitrogen from the air. Nitrogen fixation, when an excess of an available source of energy is added tothe soil, depends on the microbial flora of the soil, on chemico-physical conditions, more especially on the soil reaction and on the presence of available salts of potassium and phosphates. Next to nitrogen, phosphorus is the most important element in the nutrition of plants: none of the methods used up to the present, gives any real idea as to the quantity of available phosphorus in the soil. This can be done by the method discussed in this paper, namely by measuring the nitrogen-fixing or mannite decomposing power of the soil. A. F.

Bacillus botulinus and *Bacillus tetani* in Soil Samples.

HALL, I. C. and PETERSON, E. C. (Department of Bacteriology, University of California) The Detection of *Bacillus Botulinus* and *Bacillus Tetani* in Soil Samples by the Constricted Tube Method. *Journal of Bacteriology*, Vol. IV, No 3, pp 201-209, bibliography Baltimore, Md., 1924

The constricted tube method, employing a medium of glucose meat mash, has proved satisfactory in the detection of *B. botulinus* and *B. tetani* in soil. Seventy per cent. of arable soil samples gave toxic filtrates; 65 % contained *B botulinus*, and 20 % *B. tetani* These records are of considerable importance, pointing out the origin of *Bacillus botulinus* in preserved foods A. F.

The Soil Protozoa and their Effect on Crops.

NOVIKOFF M (Die Bodensprotozoen u ihre Bedeutung fuer die Bodenkultur) *Akten der von Portheim-Stiftung* Heidelberg, 1923.

The earliest information on soil protozoa was given by EHRENBERG (1837) and GREFF, this was, however, quite forgotten and these soil organisms did not arouse attention again until the 20th century. E. J. RUSSELL and H B HUTCHINSON (Partial Sterilisation of Soil — *Journal of Agric. Science*, Vol III, 1909) either quickly dried the soil samples kept at a temperature of 55°-60° C, or treated them with reagents prejudicial to organisms By this partial sterilisation the soil was entirely freed of protozoa, but not of bacteria, which increased rapidly owing to the disappearance of their enemies.

The protozoa might therefore be considered as soil parasites and soil fertility might be increased by their destruction.

KOCH, in his works published in the *Journal of Agric Research*, Vols. IV & V., 1915, arrived at results somewhat different from the above mentioned. The soil protozoa found by him were the following:

Flagellates: *Euglena sp*
Monas guttula
Monas vivipara
Peranema trichophorum
Rhizopods: *Amoeba radiata*
Trinema euchelys
Ciliates: *Paramaecium* sp.
Colpoda cucullus
Colpidium colpoda
Nassula elegans
Uroleptus musculus
Vorticella sp.

Glaucoma sp.
Enchelys pupa
Prorodon ovum
Condylostomum patens.

In order to separate the protozoa from the particles of soil, GODEY had already subjected a small quantity of soil to the action of the electric current and had drawn the active, i. e. non-encysted forms, to the cathode. RUSSELL and GOLDING succeeded in separating them by twice centrifuging the soil sample, suspended in water. MARTIN (*Phil. Trans. R. S. London*, Vol. 205, 1914) recommended mixing the soil with picric acid, whereby the active protozoa are brought to the surface.

KOCH however prefers the simple microscopic examination of the soil sample held in snspension in a little water. In this connection it should be observed that at 22°-24°C. the smaller infusoria develop from the cysts in 1-2 hours, the flagellates in 6-8 hours, the larger infusoria only after 40 hours, while in the well-manured, constantly moist green-house soil active forms are always to be found, which are absent in the normal, moist field soil.

These results of American investigations are diametrically opposed to those of FRANCE as regardst he protozoa who considers " that the edaphon is an indicator of soil fertility " NOVIKOFF rightly points out that the edaphon does not, like the plankton, form living communities enclosed within themselves , hence they cannot, without further explanation, be placed in the same category.

The author therefore solved the problem experimentally by investigating the free and the encysted protozoa living in the soil, as well as their oecology, their relations with bacteria and the conditions under which the cysts pass into the free state, and finally also investigated the influence of different artificial fertilisers on the soil protozoa.

Cultures of *Amoeba limax* on agar-gelatine were successfully obtained, this being of special importance in solving the problem. Later, the list of protozoa living in field soil has proved to be much greater than the works of KOCH and FRANCE led one to suppose. The following active and encysted forms were identified :

Flagellates : *Euglena viridis*
" *acus*
Monas guttula
" *vivipara*
Oicomonas
Bodo edax
" *saltans*
Astasia
Peranema
Heteronema
Rhizopods : *Amoeba limax*
" *radiosa*
" *verrucosa*

Trinema
Difflugia
Arcella vulgaris
Englypha
Centrophyxis
Mastigamoeba (1)
Ciliates : *Paramaecium anzelia*
" *caudatum*
Colpoda cucullus
Colpidium colpoda
Nassula elegans
Uroleptus musculus
" *dispar*
Vorticella nebulifera
" *microstoma*
Glaukoma
Stilonichia
Urostila
Halteria
Oxytricha
Aspidisca
Chilodon
Plematricha
Urotricha factra
Pleuronema
Lacrimonia olax

All these animal forms belong to the freshwater fauna, and are therefore not edaphic They live in the soil as it is a suitable medium for their existence, owing to the presence of minute water reservoirs.

They are but little affected by the drying of the soil. At the Moscow Agricultural Institute there were soils which had been dry for 10 years and still contained living cysts; similarly, frozen soils on thawing yielded good cultures of protozoa. Nevertheless, with regard to active forms, moisture is of the greatest importance.

In estimating the importance of the soil protozoa in agriculture, NOVIKOFF's discovery is important, namely, that the number of active protozoan forms existing in nearly all very moist soils is not great (*Colpoda cucullus, Colpidium colpoda, Uroleptus musculus, Vorticella nebulifera, Urotricha factra, Pleurotricha* and *Amoeba limax*).Though these protozoa cause wholesale destruction among the useful soil bacteria, yet, according to NOVIKOFF, this disadvantage should not be very great, for these enemies of bacteria only develop largely in saturated soils, whereas in normally moist soils they usually remain in the encysted state. It must also be considered that the injury done by the soil protozoa is compensated by their influence on the processes of soil-decomposition and the formation of humus.

With reference to the question that protozoa are to be considered as

(1) The number of the Rhizopods is much greater (Ed).

soil parasites or, as France believes, as an indication of its fertility, the author is of the opinion that the importance of the protozoa in normal soils may be compared with that of those few plants which may indeed indicate certain soil characteristics, but which have no further influence on soil fertility as far as agricultural purposes are concerned.

Herm. Fischer.

Partial Sterilisation of Soil by Antiseptics.

Matthews A *Journal of Agricultural Science*, 14, 1-57, 1924.

Quantitative tests were made of the antiseptic action of substances such as benzene and its homologues and derivatives, carbon disulphide, ammonia, formaldehye and chlorpicrin, on the soil protozoa, bacteria, fungi and eel-worms of the soil. Nearly all the substances quickly disappeared from the soil. The bacteria on the other hand are only reduced in number during the first few days, and then increase to a maximum, afterwards slowly returning to their normal number. In the better aerated and lighter greenhouse soils this process of increase and decrease proceeded much quicker than in field soils, and the greater the molecular weight and heat of combustion of the antiseptics, the quicker the increase generally. The increase in the number of bacteria was independent of the effect of the antiseptics on the protozoa Both naphthalene and toluene in large quantities, caused a considerable increase in the bacteria, but the former had no influence on the number of protozoa, while the latter killed all the ciliates and amoebae If the protozoa were killed by large doses of a suitable antiseptic, after a long period the bacteria were still further increased by a second dose. From these results the author concludes that the increase in bacteria is chiefly to be attributed to the feeding effect of the antiseptic on the bacteria and not to the destruction of the protozoa, and that the increased fertility observed by Russell and Hutchinson is, in very large measure, a consequence of the decomposition of the soil organic matter, through the increase in bacteria The increase in bacteria after liming or treating the soil with steam is similarly, partly caused by the decomposition of plant residues.The introduction of a CH_3 group in C_6H_6 decreases the toxic effect on the soil organisms, while a single Cl or nitrogroup increases both the toxic effect and the stability of the compounds in the soil.

Berju.

Factors affecting the Growth of Crops on Acid Soils.

Conner, S. D. (Purdue Experiment Station, Lafayette, Ind.). *Industrial and Engineering Chemistry*, Vol. 16, No 2, pp. 173-175 Washington, D. C. 1924.

The author draws attention to the varying nature of soil acidity.

Kappen has distinguished : (1) *free* or *active acidity* (measured by the hydrogen-ion concentration), (2) *accessory acidity*, due to aluminium silicates, iron, manganese, estimated by the action of a strong acid salt, e. g. nitrate of potassium), (3) *hydrolytic acidity*, which may be determined by deducting the accessory acidity from the total acidity (determined with lime water or by the acetate method).

The accessory acidity is most harmful to crops, as in the soil it causes the formation of hydrogen-ions, and aluminium-ions both recognised as injurious to the growth of crops. Acidity due to organic acids is only slightly injurious; it seems even that the organic substance reduces the toxicity of the other more active acidities. By HOPKIN'S (potassium nitrate) method the accessory acidity, which is for the most part mineral acidity, is measured The total acidity (accessory acidity + hydrolytic or mineral acidity + organic acidity) is measured by JONES' (acetate of lime) method. By deducting the acidity obtained by HOPKIN'S method from that obtained by JONES', we have, very approximately, the amount of organic acidity. The author in his numerous tests has found that the formula $K = H^2/I - H$ gives *an excellent index for the correction of soil acidity*, both in the case of mineral and organic acidity.

The Author in giving the practical results of his tests, points out that the toxicity of acid soils is due as much to aluminium-ions as to hydrogen-ions The results of his tests also show that some crops are more affected by aluminium-ions, others by hydrogen-ions

In conclusion the Author, from the results of his practical tests, advises that, to correct this injurious effect on crops both phosphates and lime should be added to acid soils L M.

The Injurious After-Effects of Sorghum.

BREZEALE J F *Journal of American Society of Agronomy*, Vol 16, No 11, pp 689-700 Geneva, N Y, 1924.

The author made a study of the residual, or after-effects of sorghum, which cause injury to plants of other crops that follow in rotation, and also, the effect of sorghum on the physical condition of the soil.

The results of the experiments made indicate that: (*a*) The injurious after-effect of sorghum is due to the presence of a toxic substance formed during decomposition of the stubble; (*b*) this toxic body is readily volatilised or decomposed; (*c*) during the decomposition of the stubble the soil flora that generates carbon dioxide is, to a large extent, killed off; (*d*) with the cessation of the formation of carbon dioxide, a new equilibrium is established in the soil, in which the sodium zeolite exists in excess of the calcium salt and causes deflocculation of the soil.

W. S. G.

On the Mortality of Firs in the Wienerwald.

LEININGEN, Prof Dr Wilh. Graf zu, Vienna (Uber das Jannensterben im Weinerwalde). *Forstwirtschaftliches Centralblatt*, No 5, p. 173-183, Berlin, 1924.

After the dry years 1917 and 1922, the white firs of the Wienerwald were destroyed over large stretches of country, especially the older trees with shaky tops. The immediate cause of this wholesale destruction was generally considered to be the attacks of beetles and to some extent also, fungoid disease.

So far as its course may be seen at a glance, the damage followed a west to easterly direction, without it being possible however, to attribute a definite effect to the difference in rainfall, which diminishes towards the east. There was a tendency consequently to seek the cause of the damage, in part at least, in the soil, especially as the exposure to weather conditions seemed to bear little relation to the degree of mortality.

The soils of the Wienerwald very greatly in the sandstone (Flysh) zone ; they are partly marly, but mostly poor in lime, light (with subsoil of almost pure quartz sand) to very heavy ; the latter absorb large quantities of water, but dry out in summer to a great depth, becoming cracked and hard. Only the beech shows good growth on soils very poor in lime (optimum climatic conditions). The principal humus form is " Mull ", which gradually changes into humous soil. Nitrification proceeds quite regularly ; the more ornamental forest types were found to predominate (the CAJANDERS type). Some danger however lies in the fact that the fusiform roots of the white fir become stunted in heavy soils, through twisting back, and the root system of the beech also does not penetrate very deep ; both trees show their principal root development in the upper soil layers, which are very dry during the summer. On lighter soils the roots penetrate to the lower layers, so that there is no danger here as regards the summer water supply ; neither in this case is there any bending back of the roots. The analysis of the soil (by the ATTERBERG method) gave, for the heavy Wienerwald soils, a clay content which was almost as great as that of many red earths, which accounts for such a high degree of heaviness and impermeability.

From these and other considerations, such as the quantity of precipitation during the summer months, it may be safely concluded that, the mortality among firs in the Wienerwald is caused by the exceptionally low precipitation during the growth period of certain dry years , that white firs thrive better on light soils than on heavy ones, and that the damage caused by insect pests and fungi on trees already in a very poor state must be considered as secondary only. Nevertheless, in consequence of a large increase of insects injurious to forest growths, this damage may afterwards, owing to beetles, become of primary importance. AUTHOR.

Soil Cultivation and National Farming.

SCHNEIDER Cl , (Forestry and Farming Engineer), plates 7, Helwingsche Verlagsbuchhandlung, Price M. 2.40, Hanover, 1925

The author is investigating from the point of view of a universal synoptic scheme the statics of economic relations in world and national agriculture, to which there must be recourse on the basis of a kind of natural valuation by way of an intensive increase in soil productivity. Statistical tables and sketch diagrams show the necessity of keeping this end in view, to the attainment of which soil science indicates new and promising paths. New fields of enterprise are thus offered to technologists with the participation of capital in large scale cultivation, and new chances of employment to labour. The relations with the colonies and Turkey are carefully examined, and in connection with the scheme for intensive cultivation consideration is also given to ethics, education and art, all of which are furthered by improvements in the soil. Y.

Origin of Alkali Soils and Physical Effects of Treatment.

JOFFE, J S and McLEAN, H. C. (New Jersey Agricultural Experiment Station) *Soil Science*, Vol XVIII. No 1, pp. 13-30, bibliography, figs 8 Baltimore, Md , 1924.

Among the various theories on the origin of alkali soils, the authors examine that of GEDROIZ, according to whom, from the reaction of zeolitic soda with carbonate or bicarbonate of lime, zeolitic lime and carbonate of soda are formed, without the zeolitic portion entering into solution Instead of which, it is a question of a phenomenon of adsorption. The reactions of the zeolitic portion are of a superficial character and it is clear therefore that the degree of particle dispersion is of considerable importance, especially in alkali soil, in which the colloidal content is high. According to HILGARD, the reactions between soda and lime compounds take place in the soil solution and are therefore of a purely chemical natnre. DOMINICIS' theory is analogous to that of GEDROIZ: according to the former, the hydrogels, formed by a process of substitution in certain combinations of silicates and humates, change into hydrosols. The separation of the soda and the formation of sodium hydroxide take place, and the latter combines with the carbon anhydride.

In order to improve alkali soils, therefore, either the soda in the complex silicate should be substituted (GEDROIZ's theory) or the colloids should be coagulated (DOMINICIS' theory), and finally the excess of soluble salts should be washed out. These fundamental principles should therefore be followed · 1) coagulate the colloids ; 2) wash out the excess of soluble salts ; 3) substitute the zeolitic cations ; 4) create a favourable reaction for plant growth ; 5) compensate the losses of nutritive substances caused by improvement methods.

The results of the authors' tests show that the alum treatment improves soils, but only temporarily, inasmuch as the alkalinity soon returns. If a simple washing-out could carry away the soluble salts and render the soi productive, it would be advisable to coagulate the colloids and increase permeability by the addition of alum, but this temporary remedy cannot be considered as a scientific treatment of alkali soils.

Favourable results are obtained by large additions of sulphur. The sulphuric acid hydrogen-ions formed are sufficient to substitute the cations in the zeolites and prevent the formation of carbonate of soda, and result in the formation of neutral sulphates.

Nothing conclusive can be reduced from the peat treatment tests.

A. F.

The Formation and Origin of Loess.

GANSSEN R. (Gans.). Die Enstehung und Herkunft des Loess. *Mitteilungen aus den Laboratorien der Preussischen Geologischen Landesanstalt*, Part. 4, pp. 10. Berlin, 1922. Copies may be obtained from the Preussischen Geologischen Landesanstalt, Berlin No 4, Invalidenstrasse, 44.

The author does not consider that the explanation hitherto given of the formation of loess is satisfactory, and in continuation of the views laid down in his work on the climatic soil conditions of clay silicates, gives the following conception of the formation of loess: " Loess is a formation due to temperature, but to the temperature of the soil rather than the air. It is the product of the arid, hydration-decomposition of a fine-grained, alkaline, clay-silicate, lime material, undecomposed, deficient in clay and rich in silicic acid, the gradual formation and arid decomposition of which in the temperate zones is to be traced to the influence of wind." It is further advanced and established that, though the principal part of loess is composed of grains of from 0.01-0.05 mm., the finest particles, under 0.01 mm., also contribute to the formation of loess, and further, that deposits of every kind may also aid therein, so long as their finer parts correspond to the above-mentioned conditions as regards composition and size of grain. Finally, the coloration of loess is explained and the cooperation of the subsoil under special conditions in loess formation is discussed. H HALLER.

On Peat.

SPIRHANZL, Ing J O Ueber Torf Prague, Czecoslovakia, 1924.

In this book the author describes the general properties of peat, such as water capacity, hygroscopicity, power of absorption of gases, its true and apparent specific gravity, cohesion, elasticity, capillary attraction, heat conductivity, effect of heat, and its acidity.

The formation of peat-moors is then dealt with and their geographical distribution and extent in Czecoslovakia, are discussed and shown on a map.

In the last chapters the author treats of the cultivation of peat-moors, drainage, fertilisation, etc., and the means by which they may be rendered serviceabie to agriculture, gardens, and in various industries of the Czecoslovakian Republic.

The appendix to the book contains a full index of the literature on this subject. L. SMOLÍK.

Desert Formation in Present and Past Times.

WALTHER JOHANNES, Halle. Das Gesetz der Wuestenbildung in Gegenwart und Vorzeit 4th revised edition, pp 421, illustrations 203 Published by Quelle & Meijer. Leipzig, 1924

The well-known work of WALTHER now in its 4th edition, has been greatly enriched by the more recent investigations of the author, and special mention should be made of the excellent illustrations.

There is scarcely a chapter in this book that does not add something to our knowledge of soil science (though the book is primarily intended for geologists and geographers), but throughout the whole the chief note is the great importance of climatic factors in the formation of the earth's surface, decomposition, transportation, deposition and formation of soil. The author, from personal observation of different types of deserts in various parts of the globe has obtained a clear idea of the character of deserts at the present time, and as a geologist, draws conclusions respecting the deserts of the past.

An equable, temperate climate with regulai precipitations is termed " isonom " by WALTHER, and is contrasted with an antinomial climate, full of extremes, in which not only are there large quantities of moisture in the atmosphere owing to the extensive evaporation of a tropical sea and heavy precipitations in all zones, but where, at the same time, the increased heat of the sun quickly disperses this moisture. Many phenomena can only be explained by a heavy flooding and simultaneously an intense evaporation of the upper layers of the soil. The laterite soils have been produced by such a climate, but to-day antinomial climatic conditions do not exist on our planet. Laterite soils are, according to WALTHERS, decomposed masses contemporaneous with earlier climatic conditions. The rainy tropical climate of the present day destroys the laterite soils in the same way as it does red earth, which often dates from the diluvial period and had been deposited in the chasms and fissures already existing at that time (discoveries at Capri of diluvial fauna and paleolithic tools in a red earth of 5 m thickness).

The lake at Thebes had no outflow in diluvial times, and in spite of heavy precipitations the Nile in Lower Egypt dried up in consequence of the intense evaporation and did not reach the sea. This is mentioned as an indication of the effect of the fundamentally different climate of that period as compared with the present time.

In the first part, " The Character of the Desert ", the effect of the sun and evaporation (separation of lime compounds from the water of the Nile, many rocks, e. g. sandstone, disintegrated and fissures formed, decomposition of salts and gypsum) and the action of the wind in transporting soil particles, which has the greatest effect where a desert land is subjected chiefly to a wind blowing constantly from the same direction.

The flora of the desert is dependent on the possibility of obtaining water, either from the soil, or as rain, and also on the sun's rays, wind-drying, mobility and salt content of the soil.

The second part of the book treats of denudation in the desert; transporting forces only effect loose material. Gravitation, wind transportation, erosion and the results of glacier ice, also abrasion in coastal districts, here come into play. Long after the wind has lost its carrying power signs of its former influence are found.

Disintegration is particularly well shown on the ancient Egyptian monuments, the exact age of which is known. In answer to the statement that WALTHER has sought to explain all desert phenomena by physical causes without reference to water and chemical decomposition, he replies that the desert phenomena are on the contrary polydynamic, the actions taking place in the desert to-day having a constant and mutual influence on one another.

The climate of Egypt has not changed during the last 4000 years. During this period disintegration of the monuments has been going on uninterruptedly and has not yet ceased. Weather-worn remains of walls, the wearing of holes in, and the effects of insolation on statues, the scaling and splitting of rocks, all give clear pictures of the changes taking place. The wearing away in arid zones is contrasted with the inroads made in moist and rainy climates, such as washing away of the earth's crust. The formation of a hard and deep crust forms a sharp contrast to the softening of rock crystals. The origin of numerous phenomena in regions with no outflow, is only partly to be attributed to erosion through running water ; the rest is due to transport action. Wind is the decisive lifting and moving force in desert denudation. Transportation may indeed take place without corrosion, but not the converse. A covering of stones protects against transportation. The author then describes in detail the various forms of desert denudation such as pot holes, amphitheatres, networks, the removal of knolls and dunes, etc.

In the third section : " Accumulation on the Desert ", a great deal of space is given to desert sand or dust, as a very important factor ; then also the chemical deposits (salt deposits of recent and early formation), and the relation of the desert to marine sediments, etc., is discussed.

In the fourth section : " The Desert in the Past ", the author alludes to a type of desert which is no longer to be seen, namely the lifeless original desert ; and further, of tropical deserts. with no outflow for streams, in which the greater the number of water courses which end therein, the more arid is the desert. The cold glacial desert is also greatly affected by wind transport action. The chapters : " The Allocation of the Weather Zone " and " Change of the Sun's Rays ", also " The Diluvial Snow Period and the Desert ", are of special importance for they also have a direct bearing on soil science.

In the last chapter are discussed loams, ferretto, bauxite, red earths, loess and laterite, the last being very fully treated.

A complete index of the contents very considerably facilitates the study of this valuable work. LEININGEN.

Genesis and Geography of Russian Agricultural Land.

GLINKA, K. Genesis und Geographie der russischen Boden, pp 78. *Pan-russian Agricultural and Mechanical Arts Exhibition* Petrograd, s. d.

The author, after a clear introduction in which he examines the conditions in which agricultural land is being formed, gives a brief description of the five principal soil types.

1) Laterite, found especially in the tropical zones. 2(Podsol, the name of which is derived from the Russian " sola " (ashed), on account of the white or grey colour of such soil. It is chiefly found in the forest regions with a rather cold climate ; compact, and rich in concretions,

and contains, iron, manganese and humus. 3) Steppe, the most widely diffused and most widely investigated type of which is the Chernos ("Tschernos"). 4) Marsh. 5) Solonetz, which includes soils, of which the upper part of the humus crust is looser and lighter in colour than the lower part, from which salts, generally of lime, are separated. There are different varieties of this soil, which is found also in Rumania, Hungary, Spain and the western parts of the United States, in addition to Russia.

. The author then considers the varied and extensive areas of land in Russia. The *Tundra*: A zone characterised by a low temperature (mean annual from —12° to —17° C) and by low rainfall, never more than 300 mm., sometimes less than 200. Such low precipitation renders the conditions of the tundra nearly like those of desert zones, but as a consequence, there is a hypersaturation of moisture, which favours the formation of the marshy type. Bed rocks are represented especially by marine sediments (and sand), clearly stratified with marine fossils. Here and there also rock crystals are found. The surface is varied. In some places there are quite sterile patches, deprived of humus, which approximate such soil to the podsol and solonetz type. Elsewhere the surface is covered, to a depth of 30-60 cm., by a peaty layer of a dull green or light grey colour. The peat may form hillocks of as much as 5-25 m. in diameter and 3-5 m. high. In the valleys and in places exposed to marine inundations there is the salt marsh soil, with a growth of halophitic plants. The tundra zone, the extent of which is not yet fully known, gradually passes into the forest zone.

The *podsol zone* is very extensive and is characterised by low rainfall. The mean annual temperature is slightly above 0°C in European Russia and below 0°C in Asiatic Russia, where the soil is perpetually frozen. The bed rocks are composed of sediments of the glacial period. In the moraines, the stones transported by the ice are sometimes in such quantities as to form vast spaces quite unfit for cultivation. The moraine elevations generally run in definite directions and are surrounded by enormous quantities of rocks and stones. The sediments may be considered as of fluvio-glacial origin. Not far from the moraines are vast sandy surfaces, also coming from the glacier waters. The moraine deposits are then covered with silt ; towards the south are sandy islands rich in limestone. There are also marine deposits in European Russia, while in Eastern Siberia are found rocks and crystalline schists.

The nature of the surface of the soil is influenced by the climate as well as by the rock composition. Thus in the North-West zone, where great moisture prevails, the formation of the soil is similar to that of the steppes, with its characteristic flora (*Stipa pennata*) and fauna (*Spermophilus*). The nature of the soil, both of the clay masses and of the surface mud, forming an alluvial layer, is connected with glacial action. The soil formation is quite superficial where the bed rocks are hard stones, as in Eastern Siberia. Here, owing to the presence of red sandstone, the characteristic colorisation of the podsol is absent.

In the *steppe* or *Chernos zone*, the temperature varies ; in the plant-growth period it is about 13°; in some places however the mean annual is 5°C, while in other it falls below 0°. Atmospheric precipitations are as much as 400 mm., except in Eastern Siberia, where they are less and where the soil is perpetually frozen. As bed rocks, sand (löess) predominates, but there are also silt, clay, chalk and granite. As regards the primary vegetation of the steppe, the author excludes the possibility of its having been marsh or intensely forest, maintaining instead that it was mostly herbaceous. At present the forest is formed of oaks, conifers or aspens. The soil surface stratum is far from uniform and there are different varieties.

There is no clearly defined boundary line between the *desert steppe zone*, with chestnut coloured or brown soils, and the preceding. The temperature is slightly higher, atmospheric precipitations are lower, and the soil in some places is perpetually frozen to a depth of 2-2.5 m. The bed rocks are silt, clay, sandy silt, originating from the Caspian Sea deposits. Vegetation passes from *Stipa* and *Festuca* to *Artemisia* and *Ceratocarpus arenosus* towards the South. In some zones there are quicksands; the earth is also frequently covered with fissures of 0.5-3 cm. in width. Some regions also show a hillock formation, 40 m in diameter and 1.5-2 m high, surmounted by a crater-like summit whence issues mud.

In the *grey desert steppe zone* (*Solontschak soil*), the brownish colour of the preceding zone passes to grey in the valley of the Syr-Darjia and to whiteish grey in the plains of South Russia The mean annual temperature of this zone is above 10°C, but precipitations are very slight, so that the zone is rather arid The bed rocks are formed of sand deposits, stones and pebbles. The soils are salt, except in the low zones of Turkestan, which are sufficiently drained

With regard to the *mountainous regions* and the *Crimea*, there is, in the neighbourhood of Jaila, a chestnut-coloured soil (with 3 % of humus) At the eastern extremity is the pass to the desert steppe. Elsewhere there are forests, with clayey soils, passing from red-brown to light-coloured The mean annual temperature in the uplands is 5°C, atmospheric precipitations 600 mm

In the *Caucasus*, atmospheric conditions are very varied, for regions with 2000 mm of precipitation are succeeded by those with 300. There are consequently various zones of vegetation and of soils, from that of the steppe to those of forest and lofty mountain regions.

In the *Urals*, the soil is of the podsol type in the N , and the Chernos type in the centre, and chestnut-coloured in the S.

With regard to the *Altai*, in the plain and undulating regions there are chestnut-coloured soils, with few sulphates and chlorides and with 3-4 % of humus. In the north, this rises to 8 % and there are many salts at a depth of 15-55 cm.

In *Turkestan*, two horizontal soil zones, the brown and grey, and two vertical, may be distinguished. In the lofty mountain desert zone (Pamir), with a very low temperature and extremely dry atmosphere, there is a purely surface soil only, sandy-quartz, with scanty graminaceous vegetation

The author concludes his observations by pointing out the regularity of soil distribution throughout the world; the new soil geography data render these geographical charts simpler and clearer.

A. F.

Italian Forest Soils.

I. EDLMANN, L. Analisi del terreno forestale di Camaldoli. *Annali del R. Istituto superiore dorestale fazionale*, Vol. I, pp. 27-38, 1 plate, bibliography. Florence, 1924.

II. — *Idem*. Il terreno forestale della Verna. *Annali del R. Istituto sup. forestale nazionale*, Vol. IX, pp. 39-53, 1 plate, bibliography. Florence, 1924.

I. After a short description of the forest domain of Camaldoli, the author touches on the geological formation and the climate of that region; and after having given the results of the microscopic and chemical examination of the rocks, from the alterations of which, in great part the Camaldolian forest soil originates. Data are given respecting the analyses and the physico-chemical and chemical composition, of the samples of soil taken at various depths in a section of which the lithological basis of the lateral section is a slightly calcarerous sandstone (1.60 % CO_2) and in another plot where, on the other hand, the basal rock is a sandy limestone with 26.82 % CO_2. The data are completed by the acid determinations made on various samples by the colorimetric method.

II. The author describes briefly the geological composition of Monte Penna, which rises to a height of 1283 m. in that part of the Appenines which, between the Serra and Catenaia Alps, divides the upper basin of the Arno from that of the Tiber. He then gives the results of the microscopic examination of some thin sections of the rock (miocenic lime and sandstone), from which the soil covered by the dense Varna forest chiefly originates, and the data of the chemical analysis of two samples of rock, the lithological basis of the forest soil, from one zone covered with spruce only, and from another covered with mixed spruce and beeches. The mineral soil directly overlays the live rock, the intermediary strata of altered rock being absent, and has various gradations of colour and composition, owing to the large quantities of organic matter present near the surface. Data are given of the mechanical, physico-chemical and chemical analyses (total composition and the composition of the hydrochloric acid extract) of the samples taken at various depths from lateral sections of the two zones mentioned. The result of the acidity determination made by the colorimetric method is given for each sample. The author observes that the Varna soil furnishes acqueous extracts with an acid reaction, both under the spruce wood and under the mixed plantation.

AUTHOR.

Additional Information on some Soil Types in Java and Sumatra.

·LOOS H., Bijdrage tot de Kennis van einige Bodensoorten van Java en Sumatra, 8vo, pp. 216 XV plates. Veenman & Zonen, Wageningen, 1924.

This work has been carried out under the direction of Prof. van BAREN at the Agricultural High School at Wageningen, Holland, and is divided into 5 sections and 2 appendices.

In the introduction, the author explains how his duties as Agricultural Adviser in the Dutch Indies led him to study the soil, and during his leave of absence in Holland, to pursue these studies further. In the first section of the work is described the investigations carried out on soil minerals, and in the second part the methods of investigation themselves are discussed. The author gives some valuable information on the determination of the optical properties of the soil-forming minerals. In the third section is given a description of 35 different minerals and some organisms, which were found in 6 different kinds of soil of a very heavy type, from the agricultural centres of Java and Sumatra. This section is illustrated by 14 tables and 153 photo-micrographs.

In the fourth part of the work is discussed the method which should be adopted in arranging the results of mineral investigations in order to draw definite conclusions therefrom; it is suggested that comparisons be made of the quantitative mineral determinations, by means of the magnetic process, basing on the specific weight or the optical qualities. The author prefers the last-named method, and has discovered a quantitative optical method, in which he makes use af a NEBELTAU microscope. The quantitative value can be determined by comparing a large number of samples by this optical method.

In the last section, the 6 soil sections examined are described, and the minerals found therein are again discussed, and in conclusion a general survey of the minerals is given, and the probable bedrock for each mineral is added. The appendix includes a further description of the minerals found, on the basis of recent literature on the subject, with critical notes by the author, a full bibliography being given. X.

Literature.

BAULE, B. Wirkungsgesetz und Wachstumgesetz. *Landw. Jahrb.* 49, No. 3, 1924.

BLANCK, E. and GIESECK, F. Ueber den Einfluss der Regenwermer auf die physikalischen und biologischen Eigenschaften des Bodens. *Zeitschr. f. Pflanzenernährung und Düngung*, Vol. 3, No. 5.

BLANCK, C. and PETERSEN, H. Ueber die Verwitterung des Granits am Wurmberge bei Braunlage im Harz. *Journ. f. Landw.*, 1924.

BONDORFF, K. A. and CHRISTENSEN, H. R. Determination of Organic Matter in Decomposition Experiments with Soil. *Soil Science*, XV, No. 5, 1923.

Christensen, H. R. Influence of soil conditions on bacterial life and changes in soil substance : II. Ability of soil to break down mannite. *Soil Science*, XV, No. 5, 1923.

Christensen, H. R. Undersoegelse over forskellife Fosfaters Oploeselighed. (With a summary in English). 168 Beretning fra statens Forsoegsvirksomed i Plantekultur. Kopenhagen, 1923.

Glinka, K. Die Böden Russlands und der nahaliegenden Staaten. Staatsauflage, Moskau-Petrograd, 1923. Price 3.50 gold roubles.

Glinka, K. Genesis und Geographie der russischen Böden. L'exposition panrusse d'Agriculture et des métiers. Petrograd, 1923.

Goerg, R. and Meigen, W. Untersuchungen über Ton- und Kaolinbildung. II. Ueber die Verwitterung devonicher Schiefergesteine. *Steinbruch und Sandgrube*, No. 18, 1922.

Harrassowitz, H. L. F. and Meigen, W. Untersuchungen über Ton- und Kaolinbildung. Sonderdruck aus *Steinbruch und Sandgrube*, No. 16, 1922.

Heggenhougen, Sv. Kalkens Anvendelse i. landsbruket. Besvarelse av en av. « Hirschafrondet » opsatt prisopgave. *Jourdundersoeke'sens smaskrift*, No. 12. Kristiania, 1923.

Hissink, D. J. De invloed van den Kalk op de omzetting van den humus in laagveengronden. (Effetto della calce sulla decomposizione dell'humus nelle torbiere di pianura). Rijkslandbouwproefstation, Gronigen, Afd. v. Grondonderzoek, 1924.

Hissink, D. J. *Zuchtige gronden, stempige gronden en korstige gronden.* Rijkslandbouwproefstation Groningen, Overdruk uit de Demeter-Eugeia-Almanak 1924.

Hissink, D. J. Zure gronde in Zuid- en Noordholland (Katteklei). Rijkslandbouwproefstation Groningen, Afd. v. Alg. bodenk, onderzoek, 1923.

Hissink, D. J. Einige opmerkingen over de beteeknis van het schatten van den zuurgraad van den grond door en voor de praktijk. Rijkslandbouwproefstation Groningen, Afd. v. Grondonderz., 1923.

Hudig, J. and Hetterschy, C. W. G. Die Wasserstoffelektrode. *Landw. Jahrb.*, LIX, No. 8, 1924.

Kaldhol, H. Jordburren i fraena, bug og hustad (moeve fylke). *Jordburrbnesbescrivelse*, No. 20. Kristiania, 1923.

Lemmermann, O. and Wissmann, H. Untersuchungen über das Phosphorsaurebedürfnis der deutschen Kulturböden. *Zeitschrift für Pflanzenernährung und Düngung*, Vol. II, No. 12, 1924.

Lemmermann, O. and Reserius, L. Ueber die Bestimmung der relativen Loeslichkeit der Bodenphosphorsäure. *Zeitschrift für Pflanzenernährung und Düngung*, Vol. II, No. 5, 1924.

Lemmermann, O. Wie ist es um das Phosphorsauerebedürfnis der deutschen Böden bestellt und welche Mengen an Phosphorsäure gebrauchen wir ? *Zeitschr. f. Pflanzenernärhung u. Düngung*, Vol. II, No. 12, 1924.

Lyon, T. L. Heinick, A. J. and Wilson, B. D. The Relation of Soil Moisture and Nitrates to the Effects of Sod on Apple Trees. *Cornell University, Agricultural Experiment Station Bulletin*, No. 63, pp. 25. Ithaca, New York, 1923.

Philippi, H. Contributions à la géologie de la partie méridionale de Sumatra. Gisements de fer dans les districts des Lampongs, figs. 4, table 1. University di Geneva, 1923

Rothe, J. Die Strangentfernung bei draerungen. *Landw. Jahrb.*, 49 No 3, 1924.

Schwalbe, G. and Schepp, R Die Umwandlung verholtzer Pflanzenmaterie in Kolhe, I Die Bildung kohliger Substanzen aus Cellulose *Ber der Deutschen Chem Gesellschaft*, 57, No 2, 1924.

Torstensson, G and Rathsack, K. Bodenreaktionsuntersuchungen. *Zeitschrift f. Pflanzenernahrung u. Dungung*, III, No 8, 1924.

General Notices.

The " International Reports on Soil Science ", which was originated in 1911 by resolution of the II International Soil Science Congress at Stockholm, came to an end in 1924. The Reports which are still available may be obtained from the Publishers, F. Wunder, Berlin NW., 23, Cuxhavenstrasse, 2.

The IV International Congress at Rome in May 1924 decided to publish the review in a new form as the organ of the recently established " International Society of Soil Science ", starting in 1925 and beginning with this issue, as a part of *The International Review of the Science and Practice of Agriculture*, published by the International Agricultural Institute in Rome. It is hoped that the review in this new form will continue to be useful to soil science.

As general editor I must ask indulgence, if in this first number the summary of soil science literature is somewhat incomplete, but the new organisation should soon make good this deficiency. All communications regarding this publication should be addressed to the under-signed

The Editor : Prof. Dr. F. Schucht,
Berlin-Wilmersdorf, Güntzelstrasse, 50.

The International Society of Soil Science. — The International Society of Soil Science was founded on the last day of the fourth International Soil Science Congress held in Rome, on Monday, May 19th 1924. It is hoped to give detailed information respecting the Society in the next number of the Review, especially as to the composition of the Executive Committees, of the International Sub-Committees and of the national sections formed in the different countries. If possible, the statutes and the list of members will also be published in that number. Brief notices only are given here.

In accordance with Par. 2 of the statutes the object of the Society is the encouragement and promotion of soil science in general by means of:

a) the organization of Congresses and Conferences ;

b) the formation of sectional and other committees ;

c) the publication of a review ;

d) the establishment of a central office for soil science literature and documentation at the International Institute of Agriculture in Rome.

For particular countries separate sections may be formed within the Society, for the study of soil science in general or of special branches of the subject. Every section with more than 15 members has the right to representation on the General Committee by one of its members.

Constitution of the Society:

a) the Executive Committee;
b) the General Committee;
c) the Sub-Committees.

The following persons constitute the Honorary Committee of the Society.

Prof. Dr. E. Rahmann; Prof. Dr L Cayeux; Prof. Dr. C. Glinka; Prof. Dr. Jozef Kopecky; Prof. Dr. G Murgoci; Sir John Russell; Prof. Dr. Winogr残dsky.

The following persons were appointed at Rome to form the Executive Committee:

President: Prof. Dr. Jacob G Lipman.
Acting President: Dr. D. J. Hissink.
Vice-Presidents: Prof. Dr. G de Angelis d'Ossat, Dr. Benjamin Floderus.
Editor of the Review: Prof Dr F. Schucht.
A representative of the International Institute of Agriculture in Rome;
General Secretary. Dr D J. Hissink;
Librarian: Dr G Borghesani.

The following were elected to form the General Committee:

Prof André, Prof Aso, Dr Christensen, Prof. Hesselman, Dr. Miklazewski, Prof. Novarese and the presidents of the six International Commissions:

1) for the study of soil physics, Dr. Novak;
2) for the study of soil chemistry, Prof. Dr von Sigmond;
3) for the study of soil fertility, Prof Dr. Mitscherlich;
4) for the study of soil bacteriology, Prof Dr. Stocklasa,
5) for nomenclature, classification, and soil mapping, Prof. Marbut;
6) for the application of soil science to agricultural technology, Dr. Girsberger.

Any individual or body corporate interested in soil science, is eligible for ordinary membership.

Members of the society are entitled is receive the Review free of charge on payment of the annual subscription.

It was decided in Rome to fix the contribution for the year 1924, which is to be regarded as a foundation subscription, at 2 American dollars. The subscription for 1925 will be fixed by the Executive Committee, according to the statutes. It has been suggested that this should be f. 6.50 (Dutch gulden) with an entrance fee for new members of f. 2.50. New members are asked to communicate with the General Secretary, enclosing their annual subscription and giving full particulars respecting name, title, Institution, address, etc. Every member is asked to send the annual subscription for 1925 to the General Secretary, together with the admission fee, before the 1st of April.

In accordance with par. 12 of the Statute the Executive Committee shall summon a Congress at least every five years, by arrangement with the International Institute of Agriculture at Rome. It was decided in Rome to hold the first Congress of the New Society in the United States of America.

The International Sub-Committees and the National Sections have the right under the rules of the Society to determine their own constitution. It is clear however that only members of the Society can be members of the committees or section.

The presidents of the Sub-Committees or sections are asked to inform the General Secretary as to the composition of the executive committee and other particulars relative to their committees before the 1st of April 1925.

About 300 members have paid the foundation subscriptions of 2 dollars up to the 1st of January 1925. Every member is asked to do whatever may be possible to make the new Society known among persons interested.

Gröningen, Jan. 1st, 1925.

Dr. D. J. HISSINK,
Acting First President and General Secretary,
The International Society of Soil Science,
Hermann Colleniusstraat 25, Gröningen (Holland).

AGRICULTURAL INTELLIGENCE

AGRONOMY

Agricultural Meteorology.

1. Sulphur and Nitrogen in Rainfall in Kentucky.

I. JOHNSON, E M. Sulphur in Rainfall in Kentucky. *Journal of American Society of Agronomy*, Vol 16, No. 6, pp. 353-356, tables 4, bibliography. Geneva, N. Y., U S. A.

II. FREEMAN, J. F. Nitrogen in Rainfall in Kentucky. *Ibidem*, pp. 356-358, tables 3.

I. — The author quotes the amounts of sulphur found in rainfall by twelve other workers, ranging from a maximum of 94.5 lb. per acre per annum, recorded at Knoxville, Tenn., 64.58 lb. at Leeds, England, 5.98 lb. at Lincoln, New Zealand, to a minimum of 0.61 lb. at Mt. Vernon, La.

The annual precipitation of sulphur, per acre, as recorded from 7 centres in Kentucky, from April 1921 to April 1923 averaged 29.52 lb., the maximum precipitation being in January, February, March and the minimum in July, August and September.

II. — With an average rainfall of 42.76 inches from April 1, 1922 to April 1, 1923, in six different localities in Kentucky, the soil received an average of 18.78 lb. of nitrogen per acre. Of this, 11.61 lb. was in the form of ammoniacal nitrogen and 7.17 lb. was in the form of nitrate nitrogen.

W. S. G.

2. Wheat Yield and Rainfall in Ohio.

WELTON F. A. and MORRIS V. H. *Journal of the American Society of Agronomy*, Vol. XVI, No. 11, pp 731-749, figs. 9, bibliography. Geneva, N. Y. 1924.

It has been suggested that the high yields of wheat obtained when wheat follows a crop of potatoes, may be partly due to a high nitrate content of the soil, and the accumulation of nitrates may be dependent on a low rainfall.

The author's studies of statistical data indicate that in Ohio a decrease of rainfall is accompanied by an increase in wheat yield. Sub-normal rainfall is more beneficial in autumn and early spring, than in the winter or late spring. Sub-normal rainfall in November and April appears to be most beneficial. Wheat yields are probably depressed in most years by too much rainfall. W. S. G.

3. Relation between Climate and Sugar Production in Java.

TENGWALL T. A and VAN DER ZYL C E, (Proefstation voor de Java-Suikerindustrie). Het verband tusschen Klimaat en suikerproduct op Java. *Archief voor de Suikerindustrie in Nederlansch-Indie*, No 4, pp 65-139, figs 18 Soerabaja, 1924.

Sugar production in Java has now for some time shown a constant increase, but also considerable oscillations from one year to another. The Authors investigate the causes of such increase, which is really very great, for, from 22.8 *Pikul* (1 Pikul = about 62 kg.) per *bouw* (1 bouw = m^2 7.095) in 1839, it rose to 129 1 in 1923.

Apart from other factors, such as progress in irrigation, in cultural methods etc. the Authors find that the crop is greatly influenced by climatic conditions Among these, particular attention is given to the monsoons and rains, which latter are very abundant (from a minimum of 1.314 m. per annum to a maximum of 3.388 m). By applying the formulae of the statistical method, the Authors find that it is possible to establish a correlation factor between sugar production, the October and November rains and the time of planting This factor is 0.88 and enables the year's crop to be calculated very approximately when the October and November rainfall and the time of planting are known, it being remembered that between the latter and the harvest there is an interval of nine months. With the same data the yield also may be calculated, in this case the correlation factor is 0.95. A. F.

Soil Science.

See *R*. Part II, *Proceedings of the International Society of Soil Science*, Abstracts

Fertilisers and Manures.

4. Liming of Assam Soils.

MITRA, S. K, and DUTT, S. C. *Department of Agriculture, Assam, Bulletin* No. 2, p. 3, 1923.

In various parts of Jorhat, it has been observed that certain seeds, such as oats and barley, do not germinate, even in well-fertilised soils. Analysis has shown that this is due to excessive soil acidity, the soil being an ancient sandy alluvium characteristic of many parts of the Brahmaputra valley. Such soils should therefore be corrected by liming.

[3-4]

The effects of this liming are : 1) chemical (neutralisation of acidity, alteration of potassium compounds and insoluble phosphates) ; 2) physical (clay soils are rendered less adhesive, sandy soils on the other hand become less loose and so hold water better, while their porosity is also increased) ; 3) biological (decomposition of organic substances, which are rendered available, favourable action on nitrifying organisms).

In light dry soils a small quantity of lime is applied : to every biggah (= 1337.7 sq. metres), 2-6 maunds (1 maund = 38.868 kg.) of quicklime, 3-8 of slaked lime, or 4-10 of carbonate of lime ; to clay soils containing much organic substance, double the quantity is used. The quick or slaked lime is spread as powder after the rains and ploughed in, and one month elapses before sowing, the carbonate of lime (crushed limestone) is applied at any time. The application is then repeated every 3-4 years.

A. F.

5. Analysis of Gypsum and Gypsum Products.

WELCH, F C (Bureau of Standards, Washington, D C) *Industrial and Engineering Chemistry*, Vol 16, No 3, pp. 238-341. Washington, D C, 1924.

The author mentions the forms in which sulphate of lime is most commonly found. In nature the two forms to be considered are : gypsum ($Ca SO_4$, $2HO_2$) and anhydrite ($CaSO_4$). In the gypsum industry, on the other hand, four well defined forms of sulphate of lime are to be considered . 1) gypsum ($CaSO_4 . 2H_2O$), 2) calcined gypsum or hemihydrate ($CaSO_4$ $\frac{1}{2}H_2O$), 3) soluble anhydrite ($CaSO_4$), 4) natural anhydrite ($CaSO_4$). These various forms may be easily distinguished under the microscope, whereas no method of chemical analysis hitherto in use will determine how much of each form is present. The method described by the author in this note enables the quantitative determination of each of the forms of sulphate of lime to be given

Briefly, the method proposed consists in determining · 1) the *hygroscopic* water content by heating the sample under examination to constant weight in a current of air with a vapour pressure slightly greater than the dissociation pressure of gypsum at the temperature used for the experiment ; 2) *total water in combination* content of the sample, already evaporated as above, at a temperature of 200°C, to constant weight , 3) *the quantity of water the sample is capable of reabsorbing* after having undergone the two above-mentioned treatments. This last determination is made by passing over the sample, in which the hygroscopic water content and total water in combination have already been determined, the sample having been cooled to the surrounding temperature, a current of air previously passed over 25 N. sulphuric acid. The operation is continued until no further increase in weight is registered.

From the total combined water, water taken up by the sample from 25 N. sulphuric acid to form $CaSO_4$ $\frac{1}{2}H_2O$, and analysis for CaO and SO_3. the amounts of gypsum, calcined gypsum, soluble anhydrite and natural anhydrite present in the sample may be calculated.

L. M.

6. The use of Artificial Fertilisers and Oil-Cake Residues for Tobacco Crops.

BARTELS, P. M. Onderzoekingen over de Mogelijdkheid van Vervanging van de Gebruikelijke Dessa-aarde of Stalmest door Boengkils of Knustmeststoffen. *Proefstation voor Vorstenlandsche Tabak*, No. 51, pp. 1-141, Mededeeling, 1924.

Farmyard manure and "Dessa" earth, much used in Forstenland for fertilising tobacco plantations, may be infected with *Phytophthora nicotianae*. As this fungus may cause great injury to tobacco plantations, the Experimental Station at Klaten is seeking a means of preventing the spread of this fungus, by replacing organic by artificial fertilisers. The latter, however, might to some extent be injurious to the physical condition of the soil; tests were therefore made first with various cake residues (*Soya hispida, Cocos nucifera, Eriodendron anfractuosam Jatropha*, a mixture of *Arachis* and *Eriodendron*). These were applied in such quantities that the nitrogen was equivalent to 6 grams of sulphate of ammonia per plant, and sprinkled as powder in a furrow, in which planting was to take place 3 weeks later, care being taken to mix well into the soil. The results were good in all cases; the fertiliser quickly became transformed into easily assimilable matter for the plants, which can derive benefit therefrom even when young. Unsatisfactory results were obtained with sugar molasses.

Sulphate of ammonia as a fertiliser seems insufficient, especially as regards the length of the lower leaves. Better results are obtained by adding phosphate to the sulphate. Some elevated sandy soils however require farmyard manure or "dessa" earth. In some soils the use of artificial fertilisers has no appreciable effect on yield, which was the same as when farmyard manure had been used. A. F.

7. Walpole Island Phosphate Deposits.

WRIGHT, A. M. *New Zealand Journal of Science and Technology*, Vol. VII, No. 2, pp. 91-94. Wellington, N. Z., 1924.

Walpole Island is a dependency of New Caledonia and is thus under French administration, by whom it has been leased to the Austral Guano Company.

The phosphatic guano is found as a chocolate-coloured, loose earth, in depressions of the coral rock on the top of the island; there is little doubt that the deposits originated from bird excrements.

An analysis from a composite sample representing 2000 tons of the guano gave the following percentage results: Water (hygroscopic) 11.32, water (combined) 0.39, organic matter 11.39, calcium oxide 30.36, magnesia 0.56, iron oxide 4.15, alumina 9.25, carbon dioxide 2.04, phosphoric anhydride 27.37, sulphur trioxide 0.20, silica 2.23

When subjected to a comparative citric-acid solubility test, Walpole Island phosphate compared favourably with other phosphates, the order being as follows: Ephos, Walpole, Nauru, Australian.

W. S. G.

8. The Preparation and Chemical Nature of Calcined Phosphate.

GUERNSEY, E. W. & YEE, J. Y. (Fixed Nitrogen Research Laboratory, Washington, D. C.). *Industrial and Engineering Chemistry*, Vol. 16, No. 3, pp. 228-232. Washington, D. C., 1924.

Calcined phosphate is prepared by heating to a high temperature a mixture of natural phosphate, an alkaline salt and carbon or some carbonaceous matter.

The authors point out that within the last 30 years numerous patents in connection with this preparation have been taken out. All these patents are, substantially, very similar to one another ; the only differences are in the various proportions in which the raw materials are used and in the " modus operandi " of the various processes.

The product obtained, if well prepared, contains 25 to 30 % of P_2O_5, of which only a small part is soluble in water, whereas the greater part (85-90 %) is soluble in ammonium citrate solution. It is a dry, powdery substance with a slightly alkaline reaction, and may be stored for a long time without alteration. This substance possesses the great advantage over acid phosphate that it can be used in a fertilising mixture with calcium cyanamide without reacting with the latter.

The bibliography contains descriptions of the numerous patents in connection with this preparation, but there is nothing regarding the investigation of the best conditions for effecting the optimum conversion of the insoluble phosphorus in the phosphorite into phosphorus soluble in ammonium citrate. This forms the subject of these investigations. The tests have been made in a small rotary furnace, attention being paid to the principal factors which influence the reaction such as temperature, composition of the charge, and duration of the heating period.

From the various graphs given by the authors the most favourable conditions can be deduced for producing calcined phosphate. The optimum temperature naturally varies according to the composition of the charge. If sodium sulphate be used (the salt most commonly used on account of its low price) the most suitable charge is the following : mineral phosphate 100 parts, sodium sulphate (as Na_2SO_4) 15 parts, powdered carbon 15 parts ; if it is desired to avoid the formation of powder a small quantity of water may be added, but it is not advisable to use more than 15 %. On heating this charge for 25-30 minutes at 1300°C., about 90 % of the phosphorus contained in the mineral is converted into phosphorus soluble in ammonium citrate. If on the other hand acid sodium sulphate be used (a by-product obtained in the preparation of nitric acid), the best charge is the following : mineral phosphate 100 parts, acid sodium sulphate or bisulphate 10 parts (estimated as Na_2SO_4), powdered carbon 15 parts. If this charge be heated to 1300°C. for 25-30 minutes, 80 % of the mineral phosphate is converted.

The authors then tried to discover the determining causes of the conversion of insoluble phosphate into phosphate soluble in ammonium citrate.

The quantity of sodium salt generally used for the conversion is so small that it cannot be concluded that the conversion is entirely due to the formation of a calcium-sodium phosphate of similar composition to the acid phosphate, of the probable formula $CaNaPO_4$. This was confirmed by the chemical analysis of the product. The calcined phosphate in fact always contains a minute percentage of sodium.

The authors tried to explain the conversion by the hypothesis that it is due to the decomposition of the physical structure of the rock, probably beginning by the formation of a small quantity of calcium sodium phosphate. The note concludes with some observations of a commercial character. Basing on their practical tests, the authors consider the manufacture of calcined phosphate on a large scale to be possible. This manufacture, besides having economic advantages over that of acid phosphate, might permit of the use of phosphorites which contain much iron and aluminium. The chief commercial advantage of calcined phosphate, however, is that of being able to enter into fertilising mixtures with substances of a basic nature, such as calcium cyanamid. L. M.

9 Manufacture of Phosphoric Acid by the Volatilisation Process.

WAGGAMAN, W H (Bureau of Soils, U S Department of Agriculture, Washington, D C) *Industrial and Engineering Chemistry*, Vol 16, No. 2, pp 176-179, figs 8 Washington, D C, 1924

The author points out that the manufacture of phosphoric acid by the volatilisation process is now a commercial process having many advantages over the old method of preparation with sulphuric acid. He foresees that very soon, when some investigations and researches on the question have been completed, it may be extended also to the preparation of phosphatic fertilisers. Whether fuel or electric energy be used to generate heat in this method of making phosphoric acid, it has three distinct advantages over the old system: 1) low grade phosphates may be used; 2) by using the modern electric precipitators to collect the volatilised phosphoric acid, a concentrated product is obtained by direct means without having recourse to costly filtrations and evaporations, 3) the cost of the necessary fuel or electric energy is always less than that of the sulphuric acid required by the old method.

In the ordinary furnaces the volatilisation of phosphoric acid takes place as in the electric arc furnaces, but the loss of heat by radiation, etc., is less with the use of the electric furnace.

It is very important in this work to ascertain what temperature is most suitable for the complete volatilisation of a mixture of rock phosphate, silica and carbon. Though much work has been done in this direction, it cannot be said that the problem has yet been solved. The minimum temperature necessary has not yet been ascertained with certainty. This indeed depends on many factors: on the relation existing between silica and lime in the charge, on the fineness of the subdivision of the material and therefore on the more or less close contact of the reacting substances, on the quantity of carbon or other reducing substance present, and on the time factor and the type of furnace used.

The investigation is especially interesting as regards common furnaces, for in electric furnaces it is most difficult to work at a lower temperature than that of the fusion of the mixture.

From the laboratory work done by the author it was noted that to obtain a good yield, a rather high temperature is necessary (1500-1600°C.).

Another problem considered by the author was to find the minimum P_2O_5 content of the slag, necessary to ensure an economically profitable production. If desired, the P_2O_5 of the slag may be almost completely eliminated, but the operation must be prolonged and, consequently, such a quantity of heat energy be consumed that, generally, the process is not very economical. It is well therefore not to carry this too far, the more so as the greater part of the phosphoric acid present is volatilised fairly quickly in the process.

Finally, the author observes that many important problems are connected with this system, for instance, the possible commercial utilisation of the slag (residuum remaining in the furnace). It addition, the effects caused by the high temperature, the phosphoric acid and other volatilisation products on the heat-resistent material and metallic constructional parts of the machinery, should be investigated. L. M.

10. The Manufacture of Phosphoric Acid by the Volatilization Process.

WAGGAMAN, W H, EASTERWOOD, H W and TURLEY, T B *United States Department of Agriculture, Depart Bulletin* No 1179, pp 53, figs 12, photos II. Washington, D C, 1924

An experimental investigation, carried out in a strictly scientific way, and with a view to its industrial application, showed that it is possible in furnaces to drive off practically all the phosphoric anhydride from mineral phosphates From the point of view of its industrial application, the process appears less costly than that of sulphuric acid, or the electric oven. The authors predict its industrial application. A F.

11. Errors in the Analysis of Double Superphosphates.

LARISON, E L (Anaconda Copper Mining Co) *Journal of the Association of Official Agricultural Chemists*, V, VII, No 4, pp 394-400 Washington, D C, 1924

The author's investigations, directed to eliminating possible causes of error in the analysis of superphosphates, originated from the following fact: in the purchase of a quantity of double superphosphate there was a difference in the seller's and buyer's analytical results and expert opinion had to be called in to settle the question. Even in the latter however there were notable differences. Samples of the material were then sent to 33 different chemists, who showed the following differences: for total P_2O_5, 1.81, insoluble P_2O_5, 0.64, available P_2O_5, 1.59, moisture, 2.45. The differences are the more notable in that all the chemists had used the United States official method. To discover the reason of such differences, the author examined every stage of the analysis. It is necessary above all to adhere scrupulously to the rules laid down for the preparation of the sample. The material should be reduced as soon as possible to a degree of fineness sufficient to pass through a sieve with circular holes of 1 mm. in diameter ; from this the material for the weighings should be taken. Some chemists, not satisfied with the fineness of the material, pound it in a mortar, whereupon the exposure to the air and to the rise in temperature in consequence of the pounding alters the water content. Further, as there is always a little free phosphoric acid, the latter adheres to parts of the pounded material, which cannot be reduced to powder ; so that the composition of the material is no longer comparable with that which passes easily through the sieve.

The principal errors are in the determination of moisture, and are caused by exposing the sample to the air before or during the determination and in not adhering strictly to the instructions to keep the material in the oven at the temperature of boiling water.

A further pounding will obviously cause fresh errors.

Another cause of error lies in the fact that the official instructions for determining the total phosphoric anhydride, after having prescribed the dissolving of the magnesia-ammonia phosphate precipitate in hot water, state that it should be nearly neutralized with hydrochloric acid. Now, it may happen that this approximate neutralization leaves the action neutral, or slightly acid or alkaline. The differences are not small, for they may be as much as 1.36. To avoid this error also, the author advises that the solution be neutralized after cooling with hydrochloric acid, using litmus for testing and then adding 1 cc. of hydrochloric acid of s. g. 1.18. A. F.

12. Potash from Kelp.

TURRENTINE, J. W. and TANNER, H. C. (Bureau of Soils, Washington, D. C., and University of Oregon, Eugene, Ore). *Industrial and Engineering Chemistry*, Vol. 16, No. 3, pp. 242-284. Washington, D C., 1924.

In this note, which is to be considered as a supplement to a series of articles on the same question, the authors describe, with detailed calculations, the theoretical investigation on which is based the separation of potassium chloride from sodium chloride in treating the brine. The separation of these two salts, which form the essential constituents of brine obtained after treatment of the kelp, is effected by alternate evaporation and cooling. From the theoretical investigation, illustrated by numerous graphs, as described by the authors, it will be seen how an exact estimation can be made of the concentration and composition of the various liquids, and also the determination of the best conditions under which the various operations should be carried out in the evaporator and vacuum crystalliser. L. M.

13. Field Crop Response to the Ingredients of Potassium Salts.

HARTWELL B. L., DAMON S. C., CRANDALL F. K. *Journal of the American Society of Agronomy*, Vol. XVI, No. 10, p. 660-665. Geneva, N. Y., 1924.

Under certain conditions carriers of potassium, as well as of the other two fertiliser elements, may have marked crop effects other than

those caused by the fertiliser elements themselves serving directly as nutrients.

In the authors' experiments, magnesium potassium sulphate, potassium chloride, potassium sulphate and kainit were used under such conditions that not only the potassium, but also the other ingredients should have an opportunity to exert on the crop any effect of which they might be capable.

For ten years, the basal fertiliser common to all the experiment plots was composed of materials not containing potassium, sodium, magnesium, sulphur or chlorine. These elements were added in one or more of the commercial potassium salts, and comparisons made with the no-potassium plot. On the control plot there was no apparent deficiency of potassium until 1918

During the last five years, if the average percentage increase due to the magnesium-potassium sulphate is taken as 100, sulphate of potash equals 109, chloride of potash 113, and kainit equals 135.

Sodium is useful when potassium is insufficient, and the superiority of the kainit was no doubt due to its containing about twice as much soda as potash.

If sulphur had any effect, it was apparently less than that exerted by the sodium; magnesium was evidently not deficient. W. S. G.

14. The Fixation of Nitrogen as Cyanide.

FRANCHOT, R. (Ferro Chemicals Inc., Washington, D. C.). *Industrial and Engineering Chemistry*, Vol. 16, No. 3, p. 235-238. Washington, D. C., 1924.

The problem of the fixation of atmospheric nitrogen by an economic process is of great importance to agriculture on account of the so-called « nitrogen cycle », i. e. the possibility of returning to the soil all the nitrogen extracted therefrom by the various crops.

The author points out that since 1840, when it was discovered that cyanide is formed by heating to a high temperature alkali and carbon in the presence of nitrogen, many tests have been made in order to find out whether this reaction cannot be utilised so as to render possible an industrial process for fixing nitrogen. There have always been serious difficulties however in the way of industrialising the process which until a short time ago appeared to be insurmountable.

The greatest difficulty encountered by POSSO and BOISSIÈRE in 1847 and BUCHER in 1917, was, in making use of a retort heated externally, to apply the amount of calories necessary for the reaction, which is highly endothermic and requires an enormous calorific energy and an extremely high temperature. In the second place, there were heavy losses of alkali through volatilization.

By employing modern processes in which the heating is done by electric means, and the cyanide, in vapour form, is expelled from the formation zone, it seems that the first and most serious difficulty can be surmounted, but leaving out of account the high cost of electric energy,

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these processes also possess great disadvantages. First of all the difficulty of condensing and separating the cyanide from the other secondary gaseous products present, then the difficulty of avoiding the reversibility of the reaction, whereby the cyanide formed decomposes again into alkali, carbon and nitrogen, at a temperature very near that used in the formation.

The most promising method, with a view to commercial application, is based on the principle of uniting the exothermic reaction of carbon oxidization with the endothermic reaction of the formation of cyanide by making use of a mixture of nitrogen and oxygen or simply of air.

The author illustrates and discusses in detail some very recent patents based on the above principle. These processes are very promising and meet with authoritative confirmation, as the author points out in the repeatedly observed formation of cyanide in blast furnaces, where the air or gas in the generators comes into contact with carbon and alkali at a temperature of about 1500°C. The author, who recently had occasion to determine the percentage of cyanide present in blast-furnace gases, makes some interesting observations. Among other things he observes that in the United States of America the blast furnaces have a total capacity of 40 million tons of soft iron and fix about 6 million tons of nitrogen per year.

This is about double the quantity of nitrogen calculated to be absorbed by the various crops on the whole of the territory of the United States under cultivation. L. M.

15. Utilisation of Nitrogen in Soils and Fertilisers as Affected by Lime.

LIPMAN, J. G., and BLAIR, A. W. (New Jersey Agricultural Experiment Station, New Brunswick, N. J.), *Industrial and Engineering Chemistry*, Vol. 16, No. 4, pp. 373-375. Washington, C. D., 1924.

This report contains the results of a series of investigations commenced as far back as 1898, which consist of tests made in small cylinders exposed to the air, and therefore under normal conditions, with the object of examining some phases of nitrate fertilisation. The following were used as fertilisers: nitrate of soda, ammonium sulphate, dried blood and stable manure and mixtures of nitrate and stable manure, ammonium sulphate and stable manure, dried blood and stable manure. In a first period of 10 years, the tests, which were all made in triplicate, were carried on by giving to all alike, lime in the same proportions. At the beginning of the second period of 10 years, the various cylinders containing the samples were divided into three groups, *a*, *b* and *c*. To the cylinders in the first group the various nitrate fertilisers were added and no lime; to the second group were added the usual nitrate fertilisers and lime at intervals of 5 years; those in the third group received, in addition to the nitrate fertilisers and lime (applied in the same way as for group *b*), nitrogen by means of a legume crops, twice in a period of 5 years.

The chief problems examined, in these numerous series of tests, were the following): 1) Available nitrogen in the various nitrogenous products in use, either alone or mixed with stable manure. 2) Ascertaining whether denitrification takes place when they are used in combination with nitrate of soda and stable manure in the usual annual proportions. 3) Determination of the influence of the various nitrate treatments on the proportion of nitrogen in the crop. 4) Ascertaining the extent of the loss or gain in nitrogen by the soil contained in the cylinders after the various treatments.

In this note the authors however only give a part of the data collected in these numerous tests. From these data it may be concluded that the continued use of ammonium sulphate, without lime, causes a strong acidity of the soil, so strong as to practically prevent plant growth. In the group *b* tests, on the other hand, results show that by the application of ammonium sulphate, with lime, the crops are normal. Stable manure tends to correct the injury caused by the continuous use of ammonium sulphate without lime. It was then found that, in a normal soil, denitrification does not take place when nitrate of soda is used with the right proportion of stable manure. By the use of nitrate of soda mixed with stable manure production is maintained at a high level, the increase obtained with this mixed fertiliser being often greater than the sum of the increases obtained with the two fertilisers used separately.

The same was also true in the case of mixtures of stable manure and ammonium sulphate, stable manure and dried blood and finally, in a lesser degree, in the group of cylinders to which lime was not administered. The increase of nitrogen in the various crops by using the mixed fertiliser (stable manure and one of the nitrogenous products on the market) was generally equal to or greater than, the sum of the amount recovered by using the same fertilisers separately. The percentage of nitrogen found in the dry material is, in many cases, influenced by the nitrogenous material used, and also by the presence or absence of lime, also by the fact that legume crops have or have not been introduced in the rotation of the crops.

The total quantity of nitrogen in the crop then depends entirely on the treatment with lime and on the green leguminous crop in the presence of lime. L. M.

16. Available Nitrogen in Fertilisers.

KELLOG, J. W. (Bureau of Chemistry, Pennsylvania Department of Agriculture, Harrisburg, Pa) *Industrial and Engineering Chemistry*, Vol. 26, No. 4, pp. 371-372. Washington, D. C., 1924.

The author points out that the problem of determining the percentage of available nitrogen in the various fertilisers placed on the market has been for many years an object of investigation on the part of those interested in agricultural chemistry. A practical method was sought for its determination, such as already exists in the case of water-soluble P_2O_5 and K_2O. As the methods in use do not always give concordant results, they do not solve the problem because they only give the percentage of insoluble organic nitrogen and not the total percentage of available nitrogen.

In this connection the author points out that at the meeting of the

Agricultural Departments held at New York in 1921 the advantage of investigating and establishing the form of a new method for determining the available nitrogen was discussed, as the methods with permanganate are not satisfactory and often lead to errors and confusion. The principal object of the author is to again call the attention of investigators to the subject and to show what requirements a new method should satisfy, in order to admit of profitable application.

The new method should require a single weighing of the sample and a single determination of nitrogen in addition to that of the total nitrogen, as this would save time and expense in the estimation. Further, there is need of a means, after having extracted the water-soluble nitrogen, to attack, reduce and dissolve that portion of nitrogen in the organic matter which, from determinations made by pot or field tests, must be considered as available. In other words, it should be possible to separate not only the greater percentage of available nitrogen in the ammonia compounds, but also should attack only a comparatively small portion of the nitrogen in those compounds, which must be considered to be low in available nitrogen. And finally, it should be possible to determine the non-available nitrogen.

The author has successfully used oxalic acid in a very diluted solution, as a means for attacking the organic substance in a fertiliser, in order to obtain in solution the nitrogen contained therein; the tests made show that the oxalic acid solution best adapted to this purpose is 0.01 N.

The method suggested consists in the treatment of 1 gm. of the fertiliser, first with repeated applications of distilled water (at room temperature) in order to remove the water-soluble nitrogen, then, after heating, with 100 cc. of 0.01 N. solution of oxalic acid, in order to remove the organic nitrogen, the non-available nitrogen in the residue is determined as usual by the Kjeldal method. Finally, deducting the value obtained from the total nitrogen already determined, the percentage of available nitrogen is obtained. L. M.

17. Sources of Ammonia in Potato Fertilizers.

LIPMAN, Dr. J. G. (Director, State Agricultural Research Station, New Jersey). *Bulletin* 39, pp. 171-177. The State Potato Association, Trenton, State of New Jersey, U. S. A., 1924.

The sources of fertiliser ammonia are classified under three heads, namely, ammonia from nitrates, ammonium salts and from organic sources. Ammonia compounds come largely from two sources: sulphate of ammonia and so-called base goods, the latter being produced when lower grade animal products are treated with acid in making acid phosphate. A large proportion of the ammonia in mixed fertiliser is derived from base goods.

In addition to true organic sources, such as tankage, fish and cotton seed meal, ammonia is also derived from cyanamide and in the future "urea" will doubtless play an increasing part.

In mixtures, more than one source is employed, as by so doing a more continuous supply of ammonia is given to the plant and the fertilliser is safer in use, especially from the standpoint of acidity, as the source has a great deal to do with soil acidity.

The degree of soil acidity is important in the prevention of scab, and other things being equal, only such fertilisers should be used as will reduce the danger from scab.

As regards cost, it is obvious that organic ammoniates are expensive and should be cut down, unless they are more efficient than other sources, and at best the efficiency of animal products is no greater than that of chemical carriers of ammonia.

Nitrate of soda will tend to make the soil less acid, whereas sulphate of ammonia increases acidity and where scab is prevalent the latter is the better source of ammonia. Bone meal, tankage, fish, basic slag and cotton seed meal will also have a tendency to make soil less acid, whereas chloride or sulphate of potash, acid phosphate, sulphate of ammonia and other ammonia salts will have the opposite reaction. Where the grower is confronted with a bad scab problem and drastic treatment is necessary, sulphur is the best remedy.

When the condition of the soil is such that scab is no longer troublesome, it is better to use a combination of fertilisers, in order to maintain the soil at the same degree of acidity. There is danger in the continued use of fertilisers such as would ultimately make the soil too acid to obtain a good crop. It is important to avoid dependence on acid fertilisers which in time would lead to undue accumulation of acidity in the soil, beyond the point where our particular problem is met.

W. S. G.

18. The Value of Sulphur in Soil Improvement and Crop Production (1).

LIPMAN, J. G. (New Jersey Experiment Station, New Brunswick, N. J.). *Industrial and Engineering Chemistry*, Vol. 16, No. 3, pp. 250-252. Washington, D. C., 1924.

The author first points out that sulphur and the compounds containing it are daily applied on a vast scale in all fields, and especially in that of agriculture. Besides furnishing the supplementary portion of the element of sulphur, necessary for plant nutrition, when it is not found in sufficient quantities in the soil in an assimilable form, it imparts such acidity to the soil as to prevent the growth of certain fungi and especially of certain organisms which cause serious plant diseases, such, for instance, as potato scab. Sulphur may also be used to correct the undesirable conditions of an alkali soil, to suppress and eliminate insects infesting the soil and to eradicate weeds.

In this note the author gives some data representing the result of numerous tests made by him, over a period of several years, in collaboration with other investigators, with the object of examining and controlling potato scab. These data show that the efficacy of flowers of sulphur sold on the market, is in direct ratio with its degree of fineness. Indeed, among the various qualities used in the tests, the finest (passed through a 200-mesh sieve) was in every case the most effective.

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(1) See *R.* 1924, No. 593. *(Ed.)*

The results of certain tests are then given, in which, still with a view to the treatment for potato scab, sulphur was administered together with the usual fertilising nitrates, that is, ammonium sulphate and nitrate of soda.

The best results were obtained with ammonium sulphate. The sulphur mixed with an equal quantity of ground natural phosphate, gave excellent results, superior to those obtained with sulphur alone. But besides these concrete results, the tests made by the author and his collaborators have shown the tendancy, more or less evident but always observable, to an increased yield in the crops when sulphur was used against scab. It seems then that, under determined conditions and in conjunction with other factors, sulphur has a stimulating effect on the growth of potatoes, tomatoes and perhaps also on other crops. L. M.

Agricultural Botany.

19. Evolution of Botanical Agronomical Formations in the Western Congo.

VANDERIST, H. L'évolution des formations botanico-agronomiques dans le Congo Occidental. *Revue des questions scientifiques*, Series IV, V. 6, No. 1, pp. 65-82, Louvain, Paris, 1924.

It may be concluded that towards the end of the tertiary epoch Central Africa, especially the Congo basin, already possessed the conformation and topography of the present time. The flora and fauna, from the beginning of the quarternary epoch have not become richer, some plants even have become extinct, while other have migrated, in consequence of climatic conditions. The latter have not remained constant, particularly as regards the prevalence of rains, which have been diminishing, while dry-season periods have been establishing themselves. It will be understood therefore that the geo-botanical conditions have also changed.

From these observations therefore, four geo-botanical periods may be established.

1) *Primitive.* — Before the advent of man, the abundant rains were favourable to forest extension. Many formations, especially the steppes, were richer in woody plants and contained more trees than the corresponding formations at present.

2) *Prehistoric.* — Contemporaneous with the Negrillos, prehistoric, savage non-agricultural peoples, living only on game, fish and the fruits which they gathered. They burnt certain formations, whence the flora and fauna came to be modified, becoming more and more barren. These modifications afterwards continued owing to the prevalent habit of burning the grass.

3) *Steppe formations.* — With the arrival of the Bantus in the Western Congo, the periodical cultivation of the barren sparsely-treed

steppes favoured their gradual transformation into forest formations, which in turn were used for agricultural purposes. These secondary forest formations also became transformed into palm plantations where the microbiological soil conditions were more favourable.

4) *Modern denudation of forests.* — Denudation began with the European occupation of the Congo and is characterised by the destruction of the forest formations. It may also be termed the period of empiric culture, or gradual destruction of forests. This destruction is a consequence, not of the burning of the grass, but of the abandonment of the Bantu system of cultivation.

The consequence of this period, the inconveniences of the " Raubkultur ", which is still in its initial stage, make themselves felt at present, only near the great centres. They nevertheless involve a serious question of agronomical economy, which requires attention on the part of the public authorities. A. F.

20. Serodiagnostic Investigations on Affinity between Various Dicotyledons.

RAEDER, F. Sero-diagnostische Untersuchungen über strittige Verwandtschafts Verhältnisse innerhalb der Dikotylen. *Botanisches Archiv.* Vol. VII, Nos 1-2, pp 9-10. Dahlem (Berlin), 1924.

The object of these investigations was to determine the affinity of the albumen with the help of sero-diagnosis.

The Author first states that his test method differs from that of his predecessors in that, whereas the latter limit their material to the seeds of the plants, he utilises the whole plant, and thereby succeeds in proving what had already been recognised with regard to the seeds, and that is that the plants in a fresh state impart a greater quantity of albumen to the solvents than those gathered some time previously.

As a decisive proof that it is better to test with the whole plant, the Author cites the case of *Hypericum,* from the seeds of which it was impossible to extract any traces of albumen, even with sodium hydrate, whereas this was rendered possible by treating the whole plant with hydrochloric acid.

It is also notable that albumen extracted from a plant recently gathered shows stronger reaction than in the case of dried plants.

The special investigations of the Author chiefly concern *Adoxa moscatellina, Polygala vulgaris, Arctostaphylos Uva-Ursi, Empetrum nigrum, Hypericum perforatum* and *Viscum album.*

As regards *Adoxa,* the positive reactions obtained by the Author clearly show the close affinity of *Adoxa* with *Caprifoliaceae, Dipsacaceae* and *Rubiaceae ;* with other families results are still doubtful. *Ericaceae, Celastraceae, Meliaceae, Buxaceae* and *Hippocastanaceae* are shown to be related in affinity to *Polygala vulgaris.* In the case of *Arctostaphylos Uva-Ursi* distinctly positive results were obtained with *Ericaceae, Celacaceae, Polygalaceae, Vitaceae Rhamnaceae,* and *Sapindaceae* ; less marked positive reactions were obtained with a great number of other plants.

Empetrum nigrum showed a close affinity with *Polygalaceae, Ericaceae, Celastraceae, Rhamnaceae* and *Vitaceae*, and less affinity with other families of plants.

Hypericum perforatum showed affinity with *Hypericaceae, Theaceae, Cistaceae* and *Buxaceae*. Finally, tests on *Viscum album* showed its decided affinity with *Polygonaceae, Myricaceae, Betulaceae* and *Juglandaceae* and a less marked affinity with numerous other families. G. B.

21. Simple Contrivance for Studying Root Development.

VENKATRAMAN, Rao Saheb T. S. (Government Sugarcane Expert, Coimbatore) and THOMAS, R. *Agricultural Journal of India*, Vol. XIX, Part 5, pp. 509-514, plates 4, figs. 11. Calcutta and London, 1924.

In order to study root development, especially of agricultural crops, the authors devised a method which has been found useful in the investigation of the roots of sugarcane seedlings, but is equally applicable to other plants

The apparatus consists of rings of earthenware one foot six inches in diameter and six inches high. Galvanized wire netting of two-inch mesh is cut into squares about three inches larger than the diameter of the earthenware rings.

A trench is dug in the soil a little over the maximum depth of the roots of the plant which it is intended to study. At the bottom of the trench an earthenware ring is placed and is filled with soil, on which is then laid a square of wire netting. A second ring is placed on the first, filled with soil, and on this also is put a piece of netting, the process being repeated until the rings are level with the top of the trench.

A sett of the cane variety under study is fastened to the netting on the topmost ring, or is fixed to a wire stretched across it. The trenches containing these columns of rings are filled in with soil and are then cultivated and irrigated in the usual way.

To examine the root system, when grown, the soil round the rings is dug out, planks are inserted under the lowest ring and the column is lifted out of the trench. The soil is washed out by means of a stream of water. The column is then placed inside a wooden frame to which the edges of the wire netting are fastened. The rings may now be removed with little difficulty, when the whole root system of the plant will be found fully exposed, with the roots held in the position which they occupied in the soil.

The method is efficient, and after fixing to the frame the root system of a plant may be easily photographed, an important point for the accurate recording of root development at successive stages. W. S. G.

22. Deciduous Tree Stocks with Special Reference to their Identification.

HEPPNER, M. J., *University of California, Agricultural Experiment Station, Technical Paper No.* 6 pp. 25, plates 6, table, bibliography. Berkeley, Ca., 1923.

An investigation was made with two objects in view: — (1) to determine whether the distinctive morphological differences existing between common rootstocks used for propagation of deciduous fruits in California, may be used as a means of identification of species, when only a portion of the root system is available ; (2) to differentiate between the various kinds of stocks on the basis of microscopic anatomical study of the root structure.

The following includes all the root stocks employed :—

Prunus :— *P. Armeniaca ; P. Persica ; P. Amygdalus ; P. cerasifera ; P. Avium ; P. Mahaleb ; P. Davidiana.*

Pyrus :— *P. serotina ; P. communis ; P. ussuriensis ; P Calleryana ; P. Malus.*

Cydonia :— *C. oblonga* var. *Orange ; C. oblonga* var. *Angus.*

The records made in the field and in the laboratory, described in detail by the author, have led to the following conclusions. (*a*) Ecological variations cause marked differences in certain morphological and anatomical characteristics of roots stocks, this being more marked on the *Pyrus* stocks compared with *Prunus* ; (*b*) *Pyrus* roots may be definitely separated from *Prunus* by a histological study of the following: medullary rays, shape of tracheae in cross-section, and nature of heart and sap wood ; (*c*) *Prunus Amygdalus* may be distinguished by character of lenticels, *Prunus Persica* and *Prunus Davidiana* although identical morphologically, differ as regards formation of tracheae, the former are distinguishable singly and the latter in groups *Prunus cerasifera* demands a special study of medullary ray cells and heart and sap wood *Prunus Mahaleb* and *Prunus Avium* are analogous morphologically, but are strikingly different histologically and the latter is readily identified by the astringent taste ; (*d*) Colour should not be used to identify *Prunus* stocks except in the case of *Prunus Armeniaca* with its beet-red roots, (*e*) *Pyrus* species are less easily distinguished, but the chief characteristic of *Pyrus Malus* is the large loosely fitting cells that make up the cortex , (*f*) *Cydonia* roots are practically identical with *Pyrus*, both morphologically and histologically, the only noticeable difference being the wider thickness of the *Pyrus lumina* of the wood fibres ; (*g*) *Pyrus serotina* may be distinguished from *Pyrus communis* by the study of the tracheae in the spring wood of each year, the former being less angular-walled and elongated radially.

M. L. Y.

23. Anatomy of the Root and Stem Formation of the Rape and Turnip.

SOEDING, H Anatomie der Wurzel- Stengel- und Rübenbildung von Oelraps und Steckrübe (*Brassica Napus* L., var *oleifera* und var. *Napobrassica*) *Botanisches Archiv* Vol VII, parts 1-2, pp 41-69. Königsberg, 1924.

The object of the Author's anatomical investigations is to determine whether clear and essential differences exist between the two varieties of plants named or whether such differences are merely in degree. The first question which arises in this kind of investigation, seeing that it was impossible to trace any appreciable differences between the seeds of either plant, is to determine whether such differences can be traced in the seedlings or at least in their first stage of growth. In other words, it must be determined which characteristics common to either plant continue as such until the plant has attained its full development, and which characteristics undergo a process of differentiation, and then it must be determined in what stage of growth such differentiation commences.

Investigations made on both varieties of plants, one week old, have shown that no anatomical difference can be found in them. The same result was obtained also with plants aged two and also four weeks. Only towards the age of six weeks can an initial differentiation in the two plants be noticed. These differences are: in the arrangement of the adventitious roots; in the greater or lesser degree of wood-formation of the xylem; and finally with regard to the phloem at the pith stage.

As is known, the adult rape possesses adventitious roots placed in two more or less regular lines; the turnip on the other hand, shows a lesser number of adventitious roots in various stages of growth.

Another peculiarity which distinguishes the turnip is the fact that the absence of the xylemprosenchyma with thick walls in the upper part of the hypocotile, must be attributed to a lesser aptitude on the part of the turnip to form thick xylem walls.

The rape has a well-developed root and stem, whereas the turnip springs from the root and hypocotyl, showing a tendency to form tissue and thin walls. Finally, as a greater quantity of phloem in the woody state is found in the adult turnip than in the rape, it is deduced that the aptitude to form phloem at the pith stage is greater in the turnip than in the rape.

In the later development of the two plants, the anomalies observed in the growth of the turnip may be summarised as follows:

(1) the xylemparenchyma of the central part of the plant, originating from the xylemprosenchyma; (2) leading concentric fibres at the xylem stage, with internal phloem; (3) concentric tissues at the xylem stage, with internal xylem; (4) phloem at the pith stage; (5) extraordinary development of the thickness of the pith, due to the subdivision of the cells.

In the rape No. (1) anomaly is less accentuated than in the turnip. No. (2) anomaly is rarely met with in the rape. No. (3) anomaly is also found in the rape. In the latter, phloem is also found in the pith stage. By cutting a section of the upper part of the hypocotyl, anomaly No. (5) may be observed, as in the beet. B. G.

24. Studies on the Potato Tuber.

ARTSCHWAGER, E. (Bureau of Plant Industry. United States Dept. of Agriculture). *Journal of Agricultural Research*, Vol. XXVIII, No. 11, pp. 809-835, figs. 8, bibliography. Washington, D. C., 1924.

A detailed study of the structure and development of the potato tuber, with comprehensive diagrams and illustrations which should facilitate to a certain extent the grouping of varieties, although it is indicated that the presence or absence of cells hardened by secondary deposits, the components of sclerogen, is the only definite character which can be used satisfactorily in classification.

As regards the chemical constitution of the tuber, a thorough study has been made and the protein crystals, the tannin vesicles and the solanin are considered of special interest. The accumulation of solanin is encouraged by delayed germination. M. L. Y.

25. Investigations on the Presence of Iodine in Nature.

FELLENBERG, TH. v. (Labor des eingenossischen Gesundheitsamtes in Bern). Bestimmungen kleinster Jodmengen. *Biochemische Zeitschrift*, Vol. 152, pts. I & II, pp. 116-127. Berlin, 1924.

Idem. Jodbestimmungen in Lebensmitteln, Düngemitteln, schweizerischen Mineralwassern. *Ibidem*, pp. 128-131

Idem. Über das Entweichen von elementarem Jod aus Meerwassern. *Ibidem*. pp 132-134

Idem. Untersuchungen über den Jodgehalt der Luft., pp. 135-140.

Idem. Über den Zusammenhang zwischen der Haufigkeit des Auftretens von Kropf und dem Jodegehalt der Umwelt. *Ibidem*, pp. 141-152.

Idem Über den Jodegehalt der Gesteine, der Geologischen Formation und der Mineralien und über die Bedingungen der Jodanreicherung in Erden. *Ibidem*, pp 152-171

Idem GEILINGER, H and SCHWEIZER, K Ueber das Freiwerden elementaren Jods aus Erde *Ibidem*, pp 172-184

FELLENBERG, TH v and GEILINGER, H Ueber Jodabspaltung und Jodspeicherung durch Mikroorganismen *Ibidem*, pp. 185-190.

From the works mentioned, omitting the description of the technical means adopted, the following conclusions may be drawn: Iodine is found in varying quantities in different substances. Calculated in millionths of a gram, it is found in wheat in quantities of 26-24, in ground-nuts, 200, in cod-liver-oil, 5640, in milk chocolate, 140, in liver-wort, 310 and in valerian 232.

As regards chemical fertilisers, there are 5700 in superphosphate, 192,000 in nitrate of soda and 440 in kainit.

As regards Swiss mineral waters, there are 1005 in Fortunatusquelle (Passug) and 6310 in Wildegger Jodwasser.

In sea-water there are 13-17 per litre; and it is given off by the water itself in more or less large quantities (from 2 to 8 % in about 20 days). Under natural conditions a larger quantity must be given off, and is then returned to the soil in the rain.

There are notable fluctuations in the iodine content of the air. On dewy nights a considerable quantity is dissolved in the dew, from which it evaporates into the air, where it is at its maximum in the morning and begins to diminish towards midday. The quantity of iodine is greater in the lower strata of the air than at the height of a man and tends to diminish in a vertical direction.

There is a considerable quantity of iodine in primitive geological and sedimentary formations, where it is found in an insoluble form, but is soluble in acids; the latter form is most important for plants.

There is no relation between geological formation and iodine content; sometimes, even among chemically similar minerals, there is a difference in iodine content. The iodine may be in various combinations; in some heavy minerals it may be present as insoluble iodine, in others, especially among the allanites, it is in complex combination.

The rocks increase their iodine content under the influence of meteorological conditions, soils originating from the meteorological decomposition of rocks become still richer. Acid rocks and soils absorb more iodine-ions than basic soils and rocks. From decayed, dead, vegetable matter, organically combined iodine is eliminated very slowly. Soils and rocks act as catalysers, setting free the iodine ; rocks containing ferric-oxide have the greatest influence, those containing ferrous-oxide the least. In the presence of the smallest quantities of iron, the catalysing action is stronger in proportion as the hydrogen-ion concentration is greater.

The presence of microorganisms (bacteria and moulds) decreases or obstructs the elimination of iodine by alkaline iodine solutions because the iodine which is set free becomes fixed by the microorganisms themselves.

As regards the connection between the iodine content of the surroundings and goitre, the author found that in countries without goitre the largest quantity of iodine existed in the air, drinking water, rocks, soils, milk and eggs ; the smallest quantity on the other hand was found in the cantons where goitre was prevalent Another proof that the food-stuffs in countries without goitre were richer in iodine, lay in the fact that the urine there was richer in iodine ; the quantity contained therein was greater than that which can be absorbed by the use of iodine salts, which proves the innocuity of the latter A. F

26. The Importance of Calcium for Plants.

PRIANISHNIKOFF, D Zur Frage über die Bedeutung des Calciums für die Pflanze *Berichte der deutschen botanischen Gesellschaft*. Vol XLI, part 4, pp 138-144, fig. 1 Berlin, 1923

By the water culture method the Author has been able to prove that plant growth is impeded when calcium is absent , traces of disease are observed on the leaves, and the radical system shows but slight development.

As regards the antagonism between volatile acids and calcium salts, the Author has observed that by means of diluted solutions of di-valent metals (Mg, Mn, Ba, Sr, Ca) in 0.0005-0.005/N concentrations, the cell resistence to the acid is considerably increased Calcium exerts the greatest antitoxic action. The mono-cation salts on the other hand (Na, K) in the same concentrations, exert little or no antitoxic action against the H-ions. When weak solutions of salts are used, no specific action by the anions on the antitoxic effect of the salts is observed. For instance, calcium nitrate and calcium chloride have almost the same effect A. F.

27. Daily Variation of the Carbohydrates in [the Leaves of Maize and the Sorghums.

MILLER, E. C. (Plant Physiologist, Kansas Agricultural Experiment Station). *Journal of Agricultural Research*, Vol. XXVII, No. 10, pp. 785-808. Tables 10, figs. 6, bibliography. Washington, D. C., 1924.

These experiments were made in view of the probable value, not only in interpreting the different behaviour of maize and sorghum when grown under severe climatic conditions, but also in helping to gain a better general knowledge of the fundamental physiological processes of agricultural plants.

Analyses were made of material collected at 2-hour intervals from the leaves of maize, milo and sorghum grown under identical or similar field conditions. Ten sets of plants were under observation.

Results obtained permit the following conclusions:

(1) The amount of dry matter in a given area of leaf of sorghum is greater than that of maize. In both cases the percentage increased at daylight, reached a maximum from 2 to 6 p. m. and then decreased gradually until the following morning. The maximum increase for milo was about double that for maize

(2) The leaves of maize contain a higher percentage of water than sorghum. In both cases a decrease is noticeable from midnight to 5 a. m., and a maximum from 12 midday to 3 p. m. With maize, when the minimum of 112 gm. per sq. metre of leaf water content is reached, this becomes a limiting factor in the production of dry matter. This does not apply to sorghums.

(3) The total sugars in the leaves of both plants begins to increase between 4 and 6 a. m with a maximum from 12 midday to 5 p. m. and a decrease gradually from 5 p. m till the following morning.

(4) The increase in the total sugars and insoluble carbohydrates in the leaves during the day only approximated from 46 to 92 % of the total increase in the dry matter of the leaves for the same period.

(5) The non-reducing sugars in the leaves are with the exception of the milo and sorghum, always in excess of the reducing sugars. The increase was noticeable during the day and the decrease at night, but the variation for reducing sugars was negligible. No significant differences were observed between maize and the sorghums as regards the relationship between reducing and non-reducing sugars in the leaves.

M. L. Y.

28. The Nutritive Properties of Wild Rice, *Zizania aquatica*.

KENNEDY, C (Minnesota Agricultural Experiment Station) *Journal of Agricultural Research*, Vol XXVII, No 4, pp 219-224, figs 2 Washington, D C, 1924

Wild rice, a cereal which differs considerably from common rice, is an annual plant growing in shallow lakes and sluggish water courses over extensive tracts of country in North America.

It is used as a food by some Indian tribes in the Valley of the Upper Mississipi and also, in a restricted degree, in hotels and private houses. Wild rice likewise serves as an important food for acquatic birds. It is harvested by the Indians in a primitive way, before complete maturation, so that ripening has to be carried out artificially.

The chemical composition of wild rice as compared with that of cultivated rice, is shown in the following table:

	Moistu re	Ash	Protein	Ether Extract	Cellulose	Starch	Soluble Carbohydrates such as Dextrin
	%	%	%	%	%	%	%
Wild Rice . . 1)	7.74	1.09	13.36	0.455	1.39	65.26	2.98
» » . . 2)	7.85	1.38	13.97	0.893	1.41	61.69	3.69
» » . . 3)	8.93	1.17	14.62	0.718	1.94	60.47	2.33
» » . . 4)	7.83	1.25	14.40	0.658	1.29	62.03	2.93
Coarse Cultivated Rice	12.22	1.01	5.04	2.01	1.08	69.50	0.85
Polished Cultivated Rice	12.30	0.40	8.00	0.30	0.20	79.00	—

Inorganic element content as compared with that of skimmed milk powder:

	Ca.	Mg.	K.	Na.	P.	S.
Wild Rice	0.018	0.030	0.055	0.064	0.424	0.252
Polished Cultivated Rice	0.008	0.027	0.069	0.021	0,102	0.105
Skimmed Milk Powder.	1.33	0.147	1.27	0.488	0.979	0.357

Feeding tests were also made on rats by means of the usual methods for testing deficiencies of separate feeds. The results showed that wild rice cannot be considered as an adequate feed. Although chemical analysis reveals a percentage of protein higher than that in other cereals, it seems to be of low biological value. Like other cereals, it contains insufficient inorganic matter to promote growth, and is very deficient in vitamine A, although the quantity of the latter is sufficient to prevent xerophthalmia.

Wild rice however has a higher nutritive value than polished cultivated rice because its protein contains a sufficient quantity of vitamine B to permit of animal growth, which is not the case with polished cultivated rice.

A. F.

29. An Investigation on the Toxicity of the Lima Bean (*Phaseolus lunatus*).

GREENSTREET, V. R. *The Malayan Agricultural Journal*, Vol. XII, No. 4, pp. 107-109. Kuala Lumpur, 1924.

The nutritive value of the Lima bean (*Phaseolus lunatus*) has fallen into disfavour owing to the prevalent idea that the bean contains a cyanogenetic glucoside of a toxic nature. An investigations has been made to ascertain the actual constitution and according to the analytical results here described the amount of hydrocyanic acid contained in the small quantity of beans consumed at one meal is negligible, and the author confirms the fact that the Lima bean is harmless.

M. L. Y.

30. The Relation of Root Growth to Oxygen Supply.

Cannon, W. A. (Coastal Laboratory, Carmel, California). *Ecology*, Vol. V, No. 4, ppl 319-321. Brooklyn, N. Y., 1924.

Among the surroundings in which plants live, there are two important factors (besides those obvious ones, soil and water), temperature and the supply of oxygen to the roots. The deficiency of oxygen is a factor which limits growth to a degree which depends on the temperature and on the species. The author therefore introduces the conception of a growth ratio being furnished by the growth value at a determined temperature and with a partial pressure of oxygen, divided by the growth obtained at the same temperature under normal aeration conditions.

The author's observations show that, with a low pressure of oxygen, the growth ratio varies with the temperature, and that when the temperature is constant, it varies with the quantity of available oxygen.

The explanation of this fact may be found in physical and physiological factors

A. F.

31. Studies in Transpiration of Coniferous Tree Seedlings.

Pearson, G. A (Southwestern Forest Experiment Station) *Ecology* Vol V, No 4, pp. 340-347, fig 1. Brooklyn, N. Y, 1924.

The study of transpiration may furnish much information on the relations of water to trees: water consumption in relation to growth, the capacity of adaptation to scarcity of water and that of obtaining moisture from the soil.

The author's tests were made on: *Pinus scopulorum, P. aristata, Pseudotsuga taxifolia, Picea Engelmanni. Pinus aristata* shows the highest ratio between transpiration and growth, then follow *P. scopulorum, Pseudotsuga* and *Picea.* All the species show great resistence to transpiration when the water supply is reduced to a detrimental level; resistence to drought is also afforded by the development of the root system as shown by pot tests and under natural conditions. In the former case, the compact and fibrous root system of *Pinus* and *Pseudotsuga* gives these two species as advantage; the adaptation capacity is lower in *Pinus scopulorum.* In their natural surroundings there are other differences: 3 months after germination the roots of *Pinus scopulorum* have penetrated to a depth of 15-25 cm., while those of *Picea* have scarcely reached a third of this distance. The lateral extension depends especially on the nearness of other trees: *Picea* and *Pseudotsuga* grow close together and have a hollow, compact radical system, whereas the pines grow more sparsely and their roots go deeper and are more extended. Of all the factors which favour survival in an arid situation, the depth of root penetration during the first stages of growth is undoubtedly the most important.

A. F.

32. Photoperiodism in Relation to Hydrogen-ion Concentration of the Cell Sap and the Carbohydrate Content of the Plant.

GARNER, W.W., BACON, C.W and ALLARD, H. A. (Bureau of Plant Industry, U. S A) *Journal of Agricultural Research*, Vol. XXVII, No. 3, pp. 119-156, 10 figs., 2 tab., Bibl. Washington, D. C 1924

The length of the period of the plant's daily exposure to light has considerably influenced its development and, particularly, its flowering and fructification. There are, for instance, varieties of Soy that, in the Washington latitude flower in the middle of June, others in the middle of July or at the beginning of August or of September. When the periods of daily exposure to light are shortened, late varieties flower earlier, whereas when such period is prolonged the plants continue in a vegetative state. This type of plants, which increases in height when exposed to long daily periods but flowers quickly if exposed to shorter periods, is called short-day plants. But there is also another type which, on the other hand, if exposed to short daily periods of light, tends to develop the rosette-leaf stage, without elongating the stem, and to tuberise the root, while, if exposed to long periods, it develops the stem and flowers. This is called the long-day type. There are also intermediate types.

These facts, previously ascertained by the Authors, are now investigated by connecting them with phenomena which take place within the plant, under the influence of the various periods of exposure to light. In the case of short-day plants, the undetermined stem-growth, characteristic of long periods of exposure, is associated with the progressive increase of active acidity in the plant, especially in the part where growth takes place, until the upper parts become more acid than the lower. Exposure to shorter periods, followed by a moderate increase in height and flowering, finally diminishes, and then slightly increases, acidity, but much less than under the previous conditions. The relations between the acidity of the various parts are also changed, being greater in the lower than in the upper parts. When flowering has commenced acidity decreases. The shoot has a comparatively low acidity, which increases, attaining its maximum before budding takes place. On changing the plant from long to short-day conditions, there is, after 3-5 days, a decided decrease in acidity, which would indicate the transition from the vegetative to the flowering stage; acidity then increases again. In the cases of long-day plants, when exposed for short periods they assume the rosette-development type, accompanied by a low acidity. When subsequently exposed to long periods, stem-growth and flowering take place; such development is associated with a general increase in acidity.

By increasing the length of the periods of exposure, changes take place also in the form of the carbohydrates and in the degree of hydration. In the Cosmos (short-day plants) changed from long to short periods, there is, after 48 hours, an increase of the reducing sugars, which, after a further two days, assume the form of polysaccharides, while the water-content of the tissues decreases. Twelve days later, after the shoots have appeared, the increase in the sugar-content is again in the form of monosaccharides, and there is a considerable increase in water. Observations also made on other plants show the marked influence of the periods of exposure to light on the conditions mentioned. A. F.

33. Changes in Hydrogen-ion Concentration Produced by Growing Seedlings in Acid Solutions.

DAVIDSON, J. and WHERRY, E. T. *Journal of Agricultural Research*, Vol. XXVII, No. 4, pp. 207-218, tab. 5, bibliography. Washington, D. C., 1924.

The numerous recent investigations on soil reaction have been mostly directed towards the problem of the influence of this reaction on plant-growth, while few have studied the problem from the other side, that is the effects of plant growth on the reaction of the means which supply nourishment to the plant itself. The authors, by the water culture method, have grown plants in solutions of hydrochloric acid, nitric acid, sulphuric acid, phosphoric acid, formic acid, acetic acid, oxalic acid, succinic acid and benzoic acid.

Among the inorganic acids the greatest changes take place with nitric acid, in the first stages of growth and with phosphoric acid in the last. As phosphorus and nitrogen are the most essential elements to plant growth, it may be concluded that the changes in initial reaction caused by the plant are due to absorption rather than to neutralisation.

The culture of plants in nutritive solutions, deficient in acid-forming elements, lessens the capacity of the plant to decrease the acidity of the solution itself, probably due to functional disturbances in the plant cells. The greatest changes took place with organic acids, which may be attributed partly or perhaps wholly to microbial activity. The fact that under certain conditions there is a greater diminution of one acid, and under other conditions, of another acid, indicates that the cause of these changes lies in preferential absorption. This term was introduced by the authors instead of elective absorption, inasmuch as with the latter it may be indicated that some substances are excluded from absorption, whereas the former indicates only the greater absorption of one substance rather than another. That it is a question of absorption and not of neutralisation is shown by the fact that the diminution of acidity is observed only in the case of certain acids and not in that of others, even at the same initial hydrogen-ion concentration and with the same constant of disassociation. It is precisely this fact that indicates preferential action. A. F.

Plant Breeding.

34. *Nicotiana deformis* n. sp. and the Enzymatic Theory of Heredity.

HONING J. A., *Nicotiana deformis* n. sp. und die Ensymtheorie der Erblichkeit *Genetica* Vol. V, Nos 5-6, pp. 455-476, figs. 5. S. Gravenage, 1923.

Nicotiana deformis originated in the year 1914 in Sumatra, being a bastard growth of Deli tobacco. It has never flowered in the tropics.

[33-34]

In Holland however all the specimens bear flowers when the temperature of the hot-houses is not tropical. The new species therefore is not adapted to its place of origin and has shown constancy for the first time in cold places.

Nicotiana deformis differs from the normal Deli tobacco by a slighter growth, a plentiful formation of collateral buds, and irregular long-stalked leaves through the absence of flowers, in the tropics. All these differences occur at the same time and are therefore due to a single cause.

A cross between the bastard and *deformis* gives 586 bastards and 590 *deformis* plants, and a cross between the bastard and the normal Deli, 549 Deli and 541 bastard plants in both cases; the proportion therefore is 1 : 1.

The leaf excrescences do not appear to be hereditary. The bastard is in all respects intermediary, but its characteristics are not all of the same intensity. All three types (the normal Deli, the bastard and the *deformis*) begin by forming regular leaves. This process may be explained if it is assumed that the difference between *N. deformis* and the normal Deli tobacco is quantitive and that the hereditary factors are of an enzimatic nature. *N. deformis*, with its leaf and flower anomalies reminds us not only of the Kroepoek disease, but also of the plants with the mosaic disease.

The genuine *deformis* shows somewhat slower initial growth than the Deli tobacco. G. B.

35. Inheritance of Composition in Fruit through Vegetative Propagation.

CHACE, E. M., CHURCH, C. G., and DENNY, F. E. (Laboratory of Fruit and Vegetable Chemistry). *United States Department of Agriculture, Bulletin* No. 1255, p. 18. Washington, D. C., 1924.

The object of this investigation was to ascertain whether or not there are characteristic differences of composition in lemons, which may be connected with the physical characteristics in fruits raised from different stocks. If such differences in composition really exist, the results obtained in the investigation will be useful for testing the progress of work in the improvment of lemon varieties. The data given relate to the analysis of specimens of lemons gathered from trees belonging to distinct stocks of the Eureka and Lisbon varieties.

In the latter variety, the "Dense unproductive" stock produces lemons having a greater specific weight than that of the "Bull" stock. The latter on the other hand has a larger proportion of rind than any other. The "Lisbon" stock is the most acid; the "Dense unproductive" is a little less so, and the "Open" still less. In the Eureka variety the Eureka stock is more acid than that of the "Shade Tree"; there may be other differences, but not such as to draw any conclusions from.

The results of the authors' investigations show the possibility of obtaining through graft selection (based on the choice of the best types, including therein a comparison of the fruits and examination of their physical characteristics) stocks especially adapted for the production of the essential oil and acid, or other accessory products. In any case, a more definite standard is thus obtained than by any other method for comparing the quality of fruits. It is to be hoped that these investigations will lead to practical conclusions in the choice of varieties to be cultivated for various purposes. A. F.

36. Investigations on Sugar-Cane Cytology.

Bremer, G. (Proefstation voor de Java-suikerindustrie). De cytologie van het suikerriet. Een cytologisch onderzoek van eenige practijkssorten en hare ouders. *Archief voor de Suikerindustrie in Nederlandsch-Indië*, No. 6. Soerabaja, 1924.

The previous investigations made by the Author have shown that the primary forms of Saccharum have varying quantities of chromosomes, which fact is of considerable importance in the classification of species. They also show that the number of chromosomes in the crosses between *Saccharum officinarum* and *S. spontaneum* is nearly the same as that of the parent plants. These results open the way to the discovery, through cytological tests, of the origin of the variety

This second series of cytological tests has been made on the varieties of *Saccharum* met with in practice. These varieties are also interesting in connection with the cross-growths problem, as showing how the number of chromosomes varies, tracing back to the parent-stock. Thus the Author has found that in the SW 3, SW III and DI 52 varieties there are 40 aploid chromosomes, whereas their diploid chromosomes number 80. The progenitors of these varieties, Zwart Cheribon and Batjan, both varieties of *Saccharum officinarum*, have invariably 40 aploid chromosomes. The 100 POJ variety possesses 89 diploid chromosomes. In the " Loethers cane ", which comes from *Saccharum officinarum*, there are 98-99 diploid chromosomes. The supposition that the latter is the parent of the former seems confirmed by the number of chromosomes. The 89 (100 POJ chromosomes) is equal to the sum of the 40 aploid chromosomes of " Bandjarmasin " and $\frac{99}{2}$ (" Loethers " chromosomes).

The Author, after numerous other examples, concludes by observing that in the sugar-cane there is probably some relation between fertility and the decrease, never regular, of the reduction division. Both, in all probability, are influenced by unfavourable growth conditions. A. F.

37. Bud Selection Work in Hawaiian Sugar Plantations.

C. A. B. *International Sugar Journal*, Vol. XXVI, No. 308, pp. 412-414. London, 1924.

The article summarises the recent work on bud selection of sugar canes as carried out by Shamel, Verret, and Paris. The advantages of bud selection are stated and changes due to bud variation, such as colour variation and the breaking down of striped canes into one-coloured canes (see, The origin of new sugar canes by bud-variation. Dr. C. A. Barber, C. I. E. *Agric. Jnl. of India*, Vol. I, October 1906).

The methods adopted are described for the choosing of the best clumps of cane in the field, the selection and planting of tops for seed, and the repetition of the process, year by year, until uniformity is obtained.

SHAMEL mentions the appearance of a number of mutations.

Plantation managers report that the improved condition of their crops is largely due to the use of better planting material.

Selections are at present based on the weight of cane per foot of row, owing to the difficulty of recognising the type wanted, but in the plantations a much more careful selection of seed is being made.

At present the work has two aims, (*a*) mass selection for plantation seed; (*b*) bud selection for obtaining new and improved types. PARIS proposes to separate the two, to keep back the present system for a time and to concentrate on the study of pure strains.

Two schemes have been drawn up and are given in detail for the methods to be adopted in mass, and in bud selection. W. S. G.

38. Importance of Selection as Related to Grafting on Acid-Fruit Trees.

A. D. SHAMEL, C. S. POMEROY and R. E. CARYL, Bud Selection as related to Quantity Production in the Washington Navel Orange. *Journal of Agricultural Research*, vol. XXVI, n. 7, p. 319-322, 2 tav. Washington, D. C,. 1923.

The number and quality of the fruits produced by citrus trees is a character transmissible by propagation through grafting. The tests show that the presence of unproductive acid-fruit trees is due to the unintentional propagation of growth variations of this character. This fact brings to light the great importance of accurate selection when grafting onto acid-fruit trees, in order to avoid unproductive races.

A fact which should especially to borne in mind is that the leaves of sterile shoots have a different appearance from those of normal shoots. G. B.

39. Inheritance of Petal Spot in " Pima " Cotton.

KEARNEY, T. H., *Journal of Agricultural Research*, Vol. XXVII, No. 7, pp. 491-512, 1 tab. Washington, D. C., 1924.

The Egyptian cotton similar to *Gossypium barbadense* is characterised by a conspicuous spot at the base of the yellow petals. The spot is completely absent in most of the varieties of mountain cotton (*Gossypium hirsutum* L.). The hybrid between the " Pima " variety of Egyptian cotton and the "Holdon" variety of mountain cotton has a unifactorial segregation. The subject is of practical importance through the possession of a quality of " Pima " cotton such as that with petals "free of spots ', and this fact may also be appreciated by an agriculturist.

Cotton is subject to cross fertilisation ; it is therefore a great advantage to have a character which proves race purity. The absence of spots on the petals is a recessive character which may be transmitted without difficulty to other races of the " Pima " variety. G. B.

40. Mass Selecting in Philippine Rice Fields.

MONTEMAYAR, Z. T. *The Philippine Agricultural*, Vol. XIII, No. 4, pp. 167-175, tables 6, plate 1. Los Baños, Laguna, 1924.

Mass selection may be defined as the process of selecting the best plants in a field, mixing the seeds and then planting *en masse*. This method has been employed on a large scale for rice in the Philippines since 1915.

The objects of the author's work were : (*a*) To determine the difference in yield between mass-selected and non-selected rice seed ; (*b*) the difference in yield between mass-selected and non-selected seed from a field planted one plant in a hill ; (*c*) to find whether or not mass-selection in a field planted singly, is better than mass-selection in fields where there is more than one seedling to a hill.

The experiments were carried out in 1922, 1923 and 1924 on both upland and lowland varieties of rice.

It was concluded from the experiments that :

(i) Seed, mass-selected from rice fields having several plants to the hill, did not always give increased yield.

(ii) Seed, mass-selected from a field with one plant to the hill, gave increased yield when this seed was planted one plant to the hill.

(iii) A hectare of one plant to the hill field would produce more mass-selected seed than the same area of the ordinary field with several plants in a hill.

W. S. G.

Seeds.

41. Seed Maize Improvement.

McKEON, C (Maize Specialist, Department of Agriculture). *Queensland Agricultural Journal*, Vol. XXII, Part 4, pp. 282-286, Plates 3. Brisbane, 1924

A scheme of seed maize improvement has been carried on for a number of years by the Department of Agriculture, involving highly technical work, and cooperation has taken place with growers in various districts. The average yield of the whole State for the 10 year period ending 1922 was only 21 bushels per acre.

The following yields from improved varieties have been obtained by individual farmers :

Improved Yellow Dent	117	bushels per acre
Reid's Yellow Dent	116	» »
Golden Beauty, a five-months maize . . .	93	» »
Star Leaming, a four-months variety . . .	80	» »
Funk's 90-day variety	69	» »

To maintain this improvement, sufficient pure seed will be grown each year to sow several thousand acres of maize.

W. S. G.

42. Seed Potato Improvement Methods in the United States.

I. — PERRY, P. R. Seed Potato Improvement Methods in New York. *The State Potato Association and the State Alfalfa Association, Bulletin No.* 39, pp. 205-209. Trenton, New Jersey, 1924.

II. — BEMIS, K. Seed Potato Improvement Methods in Michigan. *Idem*, pp. 210-213. Trenton, N. J., 1924.

I. — The author reviews the following methods employed in New York State in order to obtain clean seed potatoes, viz., " the index method " for the elimination of mosaic and leaf roll, which is essentially a green-house method, and the " hill selection " for field work. The practicability of seed treatment is then discussed. Several growers tried the hot formaldehyde method with some success, but with variable results as compared with corrosive sublimate.

For use on a large scale, a machine has been constructed, using the BOGGS type grader chain of small mesh. The potatoes are driven through the disinfectant solution which is contained in a vat and kept at a temperature of 126° F. After two minutes they are passed to the drying box placed directly underneath the vat, and from thence into the chute for bagging. The use of hot corrosive sublimate in place of the formaldehyde has resulted in a distinct saving of time. Tests made to ascertain the limit of resistance of the potato as regards germination capacity, indicate that a 2 minute to 10 minute period is a safe margin, taking the 4 oz. to 30 gallons strength of the solution. The temperature of 126° F was found to control 98 % of the sclerotia.

Arrangements have been made in the various districts for the use of a community vat.

To overcome the deleterious action on metallic substances such as iron, experiments have been made which demonstrate the value of a gas tar asphalt compound painted on iron surfaces. A simple chemical test is described by which the strength of the disinfectant can be readily ascertained; a pinkish orange precipitate is obtained by pouring the corrosive sublimate into a potassium iodide solution.

II. — Certification work in Michigan is in the hands of the Agricultural College and is based on the selected strains of seed potato produced by the Plant Pathology Department. The grower when applying for certification is obliged to specify :— that no potato crop has been grown on the land for the past 4 or 5 years; also the strain of seed and provenance. Treatment with corrosive sublimate is required.

If the percentage of disease exceeds 5 %, the field is condemned, and a second inspection is unnecessary. Otherwise this is considered important and also a bin inspection for wilt, black scurf and scab, and an additional inspection at loading time in case of frost injury or browning.

The author describes the organisation of the Michigan Potato Growers Exchange, the selling agent for seed growers.

M. L. Y.

[42]

43. Potato Sprouts as an Index of Seed Value.

APPLEMAN, C. O. *University of Maryland, Agricultural Experiment Station, Bulletin* 265, pp. 239-258, tables 6, figs. 10. College Park. Md., 1924.

The data obtained from these experiments give a simple and practical means of detecting and eliminating weak tubers in potato seed stock. The sprouting tests here described demonstrate the significance of apical dominance and its relation to the seed value of tubers. The conditions under which this method may be employed as a practical index of vitality in seed tubers are discussed.

Experiments have shown that when sprouts are removed from potatoes in storage and another crop allowed to grow, the total number of sprouts produced by Lot I up to planting time was nearly double that produced by Lot. 2. It is considered inadvisable to remove the sprouts before planting, if they are short and vigorous.

These investigations seem to form a basis for the final test and judging of seed potato selection and certification.

M. L. Y.

CROPS IN TEMPERATE AND TROPICAL COUNTRIES.

Cereals, Roots and Forage Crops.

44. The Origin and Value of Bena Wheat.

PRIDHAM, J T *Agricultural Gazette of New South Wales*, Vol. XXXV, Pt. 6, p 404 Sydney, 1924.

The " Bena " wheat was first observed in 1917 in New South Wales, in a plot of " Hard Federation " and since then experiments have been made to obtain a fixed strain In 1924 the producing capacity appears to have been maintained This variety produces straw of good quality and grain of a large, white, medium translucent type, giving flour of a medium strong class. " Bena " threshes readily, is rust resistant, and may be considered of general utility. The yields so far reported on the Cowra Experiment Farm amount to 54 to 65 bushels per acre, and the demand for seed is considerable. M. L. Y.

45. Paddy Cultivation.

ILIFFE, R. O. (Economic Botanist) *Leaflet* No. 28, pp. 4, Department of Agriculture, Ceylon, 1924.

In this Leaflet the author gives some useful hints on paddy cultivation, and draws the cultivator's attention to the three ways in which better yields may be obtained, viz., by better cultivation, manuring and better seed.

The crop is considered under the following heads:— cultivation, manures, sowing, harvesting, storage, seed selection, transplanting.

W. S. G.

46. Fertilising Rice.

JASEHKE, O. (Agric. Chemist, Crowley Experiment Station, La.). *The Rice Journal*, Year 27, No. 7, pp. 14-15. New Orleans, La., 1924.

In Louisiana, in former times, rice was broadcasted without any fertiliser and yields were obtained of from 67 to 90 bushels (42 lb.) per acre, whereas now the yield in many of the older sections of the State has fallen to about 25 bushels per acre. This is largely due to the fact that for 20 or 30 years these soils have grown crop after crop of rice, without rotation of other crops and only occasionally was the land pastured for a year or two.

To remedy this, acid phosphate was applied, but the improvement at first caused, soon ceased. Then phosphate-potash mixtures were tried, but with no better results. Finally, nitrogen was added, but this aided weed growth and choked out the rice.

A careful study revealed the causes of the failure ; the formula was unbalanced, more potash was necessary ; the soil was almost depleted of humus, and the one-crop system caused the increase of diseases and weeds.

The experiments had shown that fertiliser alone will not maintain a profitable yield, but that the remedy lay in the inclusion of a leguminous crop. The Biloxi soy bean was found to be the most suitable, and its inclusion, together with suitable fertilisers transformed the soil, upon which new varieties of rice have since been developed. Farmers now harvest as much as 2000 lb. of paddy per acre; the plant nutrients removed by this crop are replaced by the soy bean crop and the balance is maintained.

W. S. G.

47. Rice in Malaya.

JACK, H. W. (Economic Botanist, F. M. S. and SS.). *Bulletin* No. 35, pp. 96, Map I, plates 20. Kuala Lumpur, Federated Malay States, 1924.

The author has a thorough grasp of his subject and in this monograph treats very fully the many aspects of rice growing; the comparative values of different varieties are discussed and the necessity for the selection of strains with a high tillering power in order to obtain increased yield, also, the superiority of heavy over light grain for seed purposes.

Attention is drawn to the great importance of this cereal, which has been cultivated for more than 4000 years, and is now the staple food of over 60 % of the population of the world.

The author records the results of experimental work carried out during the past six years in the Malay States by the Botanical Division of the Department of Agriculture.

The subject is treated under the following heads: Distribution, irrigation, soils, cultivation, harvesting, yields, native methods of milling, pests and diseases, economics, varieties, manures, catch crops, improvement of the rice crops. W. S. G.

48. Potato Trials in Scotland.

Board of Agriculture for Scotland. Report of the Plant Registration and Testing Station, pp. 96, tables. Edinburgh, 1924.

Report of experiments made with numerous varieties of potatoes in Scotland during the past year, with a view to testing the yield capacity before placing on the market. Each new variety is compared with a control variety in the same class. The simple average yield of a number of plots is not considered as a sufficiently accurate indication of the yielding value of the variety under the given conditions. Consequently, a new scheme of calculation has been devised which facilitated the estimation of the real value, taking into account the probable experimental error of the plots and making adjustements and comparisons accordingly.
M. L. Y.

49. Size of Potato Sets: Comparisons of Whole and Cut Seed (1).

STUART, W., LOMBARD, P. M., VOSBURY, M. C., CORDER, G., EDMUNDSON, W. C., CLARK, C. F., and DEWEY, G. W. (Office of Horticultural Investigations, Bureau of Plant Industry). *United States Department of Agriculture, Bulletin* No. 1248, pp. 1-43, figs. 12, tables 15. bibliography. Washington, D C., 1924.

Although reports from various quarters are somewhat conflicting as regards the yield of potatoes from whole and cut tubers the data obtained as a result of experimentation in the States permit certain practical conclusions. Where there is a deficiency of moisture and plant food, medium sized cut sets are advised, as the relative number of tubers produced will have a chance to reach a marketable size. A study of stem frequency correlation shows that, as the weight of the whole seed increases from 2-6 ounces the stem frequency varies from 3 to 7 stems respectively. Halved sets show a variation from 2 to 4 stems, and quartered sets from 3 to 6 ounce tubers average 2 stems.

The authors review the causes for disagreement as to the practicability of planting whole or cut sets and draws attention to the varying climatic and soil conditions, and more especially to the spacing of the sets to allow the maximum development. A comparison is made of the experiments carried out by numerous investigators and a detailed description is given of the tests made in recent years in the States.
M. L. Y.

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(1) See *R.* 1920, No. 1096 and *R.* 1921, No. 492. (*Ed.*)

50. Potato Production under Irrigation.

RAMSAY, J. T. *The Journal of the Department of Agriculture, Victoria, Australia*, Vol. XXII, Part 7, pp. 355-360, Fig. 4. Melbourne, 1924.

The peculiarities of soil environment and climatic conditions demand variation in methods of irrigation and cultivation. The author bases his statements on normal conditions and prevention of excessive moisture. In this case, irrigation one month from the date of planting has been found effective.

Instructions are given as to the advisable methods to follow prior to irrigation:— date of planting; preparation of land for planting; manuring; cultivation. The weight of seed per acre recommended is from 12-16 cwt. preferably sprouted, and early varieties.

In practice, from 5-8 chains has been found the most satisfactory length for water to run, and on clay loams irrigation should be at a slower rate than on light soils.

The importance of cultivation after each irrigation is accentuated. The danger of excessive application of water is shown by the liability of low quality tubers to rot.

M. L. Y.

51. The Modern Trend of Forage Crop Improvement.

MCROSTIE, C. P. (Dominion Agrostologist, Central Experiment Farm, Ottawa). *Scientific Agriculture*, Vol. V, No. 1, pp. 13-17. Ottawa, 1924.

The author treats his subject from three standpoints: crop distribution and classification; experimental methods; crop improvement.

The definition of agricultural zones would be a distinct advantage, but to make use of such it is necessary to have a crop classification that will give information of the varieties and strains of forage crops, and at present a satisfactory classification is lacking. To supply this want in the case of mangels, about 10 000 measurements were made of the best varieties. Four measurements were taken of each root: length, width at widest part, depth in the ground, and distance from tip of root to widest part. The following table gives the averages for varieties listed by seedsmen:

Variety	Length width ratio	Length depth ratio	Length distance to widest point ratio
Long	3.310	1.981	1.299
Half Long	2.915	2.044	1.329
Intermediate	2.065	2.261	1.511
Tankard	1.594	2.088	—
Globe.	1.074	2.405	1.597

The table shows that there is a well defined difference between the length-width and length-depth ratios of the types. These differences are definitely co-related with adaptations to particular soil types and conditions, and are therefore of economic significance.

The seedsman's descriptions are not sufficiently accurate, and a better classification is essential if growers are to receive full protection under the new Seed Control Act.

As regards experimental methods: In comparative tests for yields of varieties, reports were almost always given in terms of the harvested, or green weights. The dry matter contained in the crops is the important factor, hence such green-weight reports may be very misleading, and the relative positions of varieties will be radically changed, as shown by the author, if the report is given in terms of dry material rather than as green weight.

The improvement of forage plants has been less rapid than that of cereals, owing to the former being generally open-fertilised.

The purification of a plant as regards its character can be done most quickly by self-fertilisation, as by that means, in four or five generations the true breeding strains may be separated. Inbreeding may result in decreased yield, in which case recombination of desirable strains may be necessary to restore vigour. However, many of the best timothy strains, inbred for 5 generations at the Central Experiment Farm gave higher yields than the best commercial mixtures.

Another feature of modern work is the utilization of hybrid vigour shown by many first generation plants resulting from crosses of dissimilar types; maize hybrids promise to be of economic value.

Finally, there is a trend among plant breeders of all kinds to co-operate in experimental work, which will bring about better and more uniform results. W. S. G.

52. The Agricultural Value of Trefoil.

BRESAOLA, M. *Le Stazioni sperimentali agrarie italiane*, Vol. LVI, parts 7-8-9, pp 313-325, bibliography. Rome, 1923.

In the tests made by the author on plots of 100 m², under as far as possible the same conditions, a comparison was made of 8 different kinds of trefoil and 10 of clover, including some foreign varieties. It was proved that the influence of origin on the crop value of the seed necessitates still more restricted regional classifications than have hitherto been made. With regard to Italy, the utilisation of Italian seed is not sufficient, attention must be paid to the place of origin. If the tests had been carried out contemporaneously in all the districts from which the seeds came the results would, in all probability, have been different, and favourable to the respective home variety.

Low temperatures cause clover to thin out, tests made in this connection showed the great resistence of the home variety. In mixed varieties there are sometimes small species having a varying degree of resistence to cold. Selection after repeated sowings, while it leads to the thinning out of the meadows, eliminating the less resistent plants, will soon give a variety particularly well adapted to local conditions, and therefore more productive. Seed production is scarce in Italy and should therefore be encouraged. In view of the great increase in fodder production, every initiative in this direction would be valuable. A. C. M.

53. Fodder Value of *Melinis minutiflora.*

WHITTET, J. N. *Agricultural Gazette of New South Wales*, Vol. XXXV, Pt. 6, pp. 431-432, figs. 3. Sydney. 1924.

Reference has recently been made to the value of " efwatakala " grass (*Melinis minutiflora*) in Africa, in connection with the tse-tse fly problem (1). The author draws attention to the tests made in New South Wales since the introduction of this plant some years ago. The matter of planting this grass (here known as " molasses " grass) in tick-infested areas has received consideration, but the fact that stock are not partial to this plant presents a certain drawback.

As regards cultivation, as a tropical grass, it requires a long summer season with heavy rainfall and good soil conditions if introduced into non-tropical climates. The main methods of propagation are by rooted cuttings, runners or divisions of the main root system.

M. L. Y.

54. Tropical Gramineae Harmful to Pastures and Stock and Fodder Value of other Plants in the Belgian Congo.

VANDERYST, H. I. Graminées Tropicales reputées nuisibles. — II. Appetibilité pour le bétail de quelques graminées cultivées au jardin agrostolograque de Leverville. *Bulletin agricole du Congo Belge*. Vol. XIV No. 4. pp. 545-568. Brussels, 1923.

I. — A list and description of the various species of Gramineae deleterious (1) to arable land; (2) to pastures; (3) to live stock, based on observations made in the Belgian Congo.

II. — A classification of forage plants of superior, medium and inferior value for sheep, and others entirely avoided by stock.

M. L. Y.

55. Improvement of Grassland.

HANLEY, Dr. J. A. (University of Bristol). *Journal of Ministry of Agriculture*, Vol. XXXI, No. 3, pp. 251-260, tables 3, London, 1924.

There are large areas of poor grassland in Yorkshire which can be very much improved by the application of suitable phosphatic fertilisers. Some of the commonest indications of land requiring phosphates are growths of hawthorn, wild rose and sedges; fescues are often the chief grasses.

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(1) See *R*. 1923, No. 187. (*Ed.*)

On heavy soils, or on light soils with a good supply of moisture, either high, or low-grade basic slags, or finely-ground mineral phosphate usually gave satisfactory results on grassland requiring phosphate, but the lighter and drier the soil the more soluble should be the phosphate employed. Steamed bone flour alone, or mixed with superphosphate, gave good results on light, dry grassland, whereas superphosphate alone answered well on limestone land.

Disappointment is often caused through the use of inadequate applications; the initial application should not be less than the equivalent of 10 cwt. per acre of phosphatic manure containing 30 per cent. total phosphate of lime.

In some instances where lime or phosphatic fertiliser made a marked improvement in poor grazing land, the addition of potash produced a further improvement, but this was always small in comparison with that due to lime or phosphate alone.

The experiments indicate that it is better to make the application of phosphates (and lime if necessary) the first step in the improvement of poor grazing land, and to give adequate dressings to the whole area to be improved before supplementing such treatment by the addition of potash. The evidence is more definitely in favour of the use of potash for hay crops from temporary leys or permanent meadows, especially if no farmyard manure is used. W. S. G.

Industrial Crops.

56. **Cotton in Peru.**

The information on which these notes have been based has been derived from the following sources:

(1) Communication from Señor Oscar Victor SALOMÓN, Peruvian Consul General in London, dated 16 September, 1924.

(2) *Commerce Report, Supplement* No. 43 (Washington); also, particulars from the *Trade and Economic Review.* Data relative to trade and production have been communicated by the Peruvian Government.

(3) *Estadística de Comercio Especial del Peru.* Superintendencia General de Aduana, for the years 1910 to 1924; Extracto estadístico correspondiente del año 1918, preparado por la Dirección de Estadística del Ministerio de Fomento, 1915 to 1918.

(4) Consular Reports to the British Foreign Office on the finance, industry and trade of Peru, 1921 to 1924.

(5) "*Peru, the Cradle of South America*", July, 1924, No. 1, p. 18. London, Peruvian Consulate General.

(6) F. B. Peel, a Director of the Liverpool Cotton Association has also supplied information.

(7) *The Cotton Growing Countries.*

The coast of Peru consists chiefly of a line of arid sand dunes, intersected by numerous river valleys. These rivers have only short courses, nowhere exceeding a length of 100 miles, and many of them descend in less than fifty miles from their sources in the Western Cordillera of the Andes to their discharge into the Pacific Ocean. The steep water gradients thus formed have been favourable to irrigation in the valleys, and the channels required for this purpose had been extensively provided in the era of the Incas, if not earlier. Cultivation in those days appears to have been chiefly concerned with the supply of food for the cosiderable population then found in Peru. As this coast-region is almost entirely rainless, water for agriculture of any description is, as a rule, only obtainable by means of irrigation.

Cotton growing and manufacture were undoubtedly Peruvian industries during early times ; this fact is attested by the numerous exquisitely coloured cloth fabrics recovered from the cemeteries of the Inca Empire. The Inca dynasty appears to have included keen agriculturists and great industrialists among its members ; there is evidence to show that the manufacture of cotton textiles was more than enough for Peruvian requirements, and allowed supplies to be sent to the territories now known as Chile and Ecuador, and indeed to more remote parts of the Peruvian Empire. Under Inca rule strenuous work was imposed upon the whole population, with excellent results, both agricultural and industrial.

During their three centuries of dominion, the Spanish Government had established factories, and granted permission to the natives to continue their cotton weaving. The irrigation channels, however, fell into decay during this period, and by degrees cotton growing was practically abandoned. Even after Peruvian independence was achieved in 1821, the output continued to be on a comparatively insignificant scale, until the American Civil War, when the great rise in the price of cotton encouraged the planting of varieties hitherto unknown in Peru. But there was no instruction available as to methods of growing the crop, nor any knowledge of scientific developments ; this sudden prosperity was only temporary, and the industry soon relapsed into its previous stagnation.

It was not until 1899 that any real progress in cotton growing was apparent in Peru, but after that date a remarkable and rapid increase in production was to be observed.

There are at least 35 valleys in which cotton is grown, and twenty ports from which it can be exported. The areas are relatively small and isolated from each other by the recurrent line of sand dunes, which detracts so much from the interest of a voyage along the west coast of South America. Many of the snow-fed streams from the Andes run dry during the autumn months, and planting is therefore only practicable during the flood season or when irrigation remains possible.

The wonderful climate of these valleys and their suitability for cotton growing may be attributed to the evenness of the temperature ; the difference between the day and night readings of the thermometer, being almost regular, provides the most favourable conditions for the growing plant. The salt spray from the ocean breezes deposited upon leaf and stalk provides a layer of sodium chloride, and the prized " Full Rough "

Peruvian cotton is the result. This roughness becomes more pronounced with the degree of proximity to the sea, while on the other hand, attempts to grow a similar grade at a distance from the shore have usually failed. In fact, as the intervening mileage increases, the cotton grown from " Full Rough " seed becomes less rough, and the equally famous " Moderate Rough " is obtained in the upper portions of several of the valleys, in this way.

For a few years after 1899, the increase in production was rapid, the average export reaching 17,000,000 pounds, by 1907, and 35,000,000 in 1908. Disaster, however, followed, for the cotton plant is nowhere immune from disease. The fungoid growth at the ground level, which produces wilt, had gradually sapped the strength of the plant, during its life period of five or six seasons.

After 1908 the yield everywhere diminished rapidly, and it was feared that the whole of the cotton crop might disappear. Plant after plant became infected, there was a cessation of any appreciable yield. Whole fields were destroyed and there was very little expectation of finding any satisfactory remedy. But the occasion produced an investigator equal to dealing with the situation.

Señor Fermin Tanguis came to Peru from the West Indies, early in life and after some twenty years of varying experiences, in 1893 he began cotton growing on his own estate, Hacienda Urruita, with the knowledge gained from practice, and with some printed descriptions of the methods of selecting perfect cottonseed and healthy plants, as adopted in other countries ; he devoted his entire attention to a scheme for combatting the attacks of wilt which had resulted in such wide spread destruction.

The principle upon which he worked was the simple one of evolving, by a process of elimination of the unfit, the perfect mother-plant from selected seed of *suave*, or smooth, upland cotton. During three successive seasons he made careful sowings of selected seed on an infected area. In the first, and again in the second season conditions remained unchanged, the wilt still prevailed and destroyed all the crops. But in the third season a single plant stood erect, and was quite free from infection. In the fourth season the seed collected from this mother plant produced others, true to type. In the fifth season Señor Tanguis was in a position to sow seven acres with the new type of cotton, which has since borne his name. Nearly forty acres were sown in the sixth season, and in the seventh Señor Tanguis began to supply seed to cotton planters in the Department of Ica. Occasionally plants do not remain immune, but these cases are so rare that they do not vitiate the possibility of plentiful crops.

In some valleys, such as that of Cañete, Tanguis cotton is grown on the largest scale and yields sometimes reach 800 pounds of lint per acre. The same plant may remain in being for five seasons ; the staple attains a length of 1 3/4 inches, with a very strong resistance ; it is classed as half (or moderate) rough. Of all the cotton now growing in Peru, 60 % has in fact been derived from the single mother-plant reared by Señor Tanguis.

In the Government statistics of exports so lately as 1918, Tanguis Cotton is not separately mentioned, but in the data for 1922, this variety easily heads the list, with an export figure of 32,212,000 pounds. It forms part of the cotton shipments from fourteen out of the twenty ports tabulated in the Government returns in which the aggregate exports of cotton from Peru in 1922 are given as about 88,000,000 pounds. Sixteen years ago, previously to the wilt attack, the whole Peruvian cotton shipments of 35,000,000 pounds only slightly exceeded the figure of Tanguis cotton exported in 1922.

The system of selection adopted by Señor Tanguis is not now confined to the variety which bears his name. As and when required, Full Rough plantations have been subjected to the same methods of careful selection. This Full Rough cotton is not only indigenous in Peru, but is unique, not being found in any other country ; the essential conditions of favourable climate and soil made fertile by irrigation are nowhere else combined with that propinquity to the sea which is required for its production of the rough texture. Full Rough cotton bears twice in the year, and is good for five or six crops without replanting. It is so woolly in texture that scientific analysis may sometimes be necessary to differentiate it from real wool, and the Yorkshire manufacturers value its properties.

It is only from the parts of Callao and Payta, in Northern Peru, that Full Rough Cotton has been exported and to the extent of about 6,800,000 pounds in 1922. About 800,000 pounds of this cotton was yellow stained from weather effects, and presumably most of it went, as usual, to United States' buyers.

The cotton known as Moderate Rough or Half Rough (semiaspero) is usually available for export in smaller quantities than Full Rough, and is shipped from the same northern ports of Peru ; as already mentioned, this grade of cotton may be considered to be the result of planting Rough seed at a distance from the sea coast ; the quotation in Liverpool is usually about 10 per cent lower for Moderate Rough than for Rough Peruvian Cotton.

The original and indigenous unimproved *Gossypium Peruvianum* is still grown in such valleys as Catacaus, Sechura, and the ancient forest area in La Chira, which is so much enriched from the point of view of present agricultural conditions by deposits of river alluvium. Here in La Chira and elsewhere the method of planting usually adopted is to sow in small holes, 15 or 20 feet apart, in unploughed land and to irrigate by means of channels from the river. In the spaces between the cotton plants melons, pumpkins or beans are sown. The first crop of cotton matures in about eighteen months but does not give a full yield. In the following seasons however, production continues to increase until the sixth crop, then the plant dies off. Of all Peruvian growths this unimproved *Gossypium Peruvianum* gives the lowest average yield of 235 pounds per acre ; yet this is a higher output than that obtained of late years in the United States.

Gossypium Herbaceum (Suave or Smooth Peruvian) derived from American Upland cotton, forms its best plantations at Lambayecque in the Rimac (Lima) valley, in Chancay, Lurin, Cañete, Chincha and the Ica region. It thus extends along most of the sea front of Peru, and contributes to the export figures of nearly twenty ports with an aggregate of about 20,000,000 pounds (1922 figures). The Upland Cotton requires more water than the indigenous varieties, previously mentioned, and generally compensates for the extra care, by producing better results. In Lambayecque the average has been fully 500 pounds of lint to the acre, and in the Ica valley 562 pounds have been registered, while in Chancay, Chillon and Rimac, variations in yield from 360 pounds up to 830 pounds are recorded.

The Upland Cotton plant has become perfectly acclimatized and grows in the form of a shrub from 3 to 4 ½ feet in height. Its period of bearing is about two years, the output declining sharply both in quantity and quality in the third year.

Of the *Gossypium Barbadense*, the production of actual Sea Island Cotton is trifling, but the derivation from the same original stock is said to be maintained in Mitafifi Cotton, received in Peru from Egypt, and also figuring at the present day in the Peruvian exports to an extent of about 20,000,000 pounds.

This cotton is grown in the valleys of Pativilca, La Chira, Supe, Huacho, etc. and, finds its outlet at most of the twenty Peruvian ports of shipment. The yield averages about 500 pounds of lint per acre.

There is yet another region where indigenous cotton has given good results, though, so far, on a somewhat limited scale. The Montana, or Peru Oriental territory is one of vast possibilities, with great areas of fertile soil. It is situated to the east of the great range of the Cordillera, and is watered by the upper courses of rivers tributary to the Amazon.

The variety of cotton produced in this Peruvian Orient is known as Chanchamayo, and about 2,200,000 pounds were exported from the river port of Iquitos, down the Amazon, in 1922. Most of the cotton shipped from Iquitos is classed as Moderate Rough, and has a staple of 1 $^1/_8$ to 1 $^3/_{16}$ inches.

Throughout the country, the cotton plantations are mainly in the hands of well-to-do Peruvians, who employ the labour of the Indian natives. A large proportion of the dwellers in Peru are almost entirely self-supporting, or rather self-providing, as communities, in respect of food and clothing, so that much of the cotton grown is devoted to domestic requirements of all sorts.

In the Apurimac valley, new spinning mills have been established, and the demand for the raw material has led to a considerable extension of the cotton area.

The ginning is in many cases carried out locally, on the estates themselves, and the cottonseed is very extensively utilized in crushing mills, with a resulting trade in cotton cake and oil.

In Peru the list of cotton plant pests and diseases is not a long one So far, there is no trace of boll weevil or of pink bollworm (*lagarta rosada*). The *arrebatada* does some damage nearly every season, but the extent of

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injury is not large. The fungoid attacks resulting in wilt have already been mentioned, and have caused by far the most serious losses to Peruvian cotton-growing, though, in recent years, careful seed selection and cultivation, on the Tanguis plan have rendered the risk of wilt less formidable than it was fifteen or twenty yearsago.

According to the expert opinion of Señor Oscar Victor Salomón, Peruvian Consul General in London, who is the chief authority quoted on cotton-growing in Peru, there are three miillion acres of land in that country which are suitable for cotton. Undoubtedly this opinion is contingent on the provision of efficient means of irrigating the whole of the territory indicated.

In the 35 valleys scheduled as cotton growers in the Peruvian Government's Statistics the present area under this crop does not greatly exceed 200,000 acres; there is, evidently plenty of room for extension, conditional always on the provision of irrigation facilities. At the beginning of these notes reference was made to the ancient water channels as forming an indispensable foundation for cotton growing. Some notice of the new efforts for increasing the water facilities may properly conclude the present statement.

The Pampas Imperial Scheme has already provided for 20,000 acres and the Carhuaqueros Dam, fifty miles inland from the port of Pimentel will, when complete, furnish water for another 125,000 acres in the neighbourhood of Lambayeque. As food and other crops will share in the benefits of these new ventures, the additions to cotton production cannot be very rapid, though perhaps fairly continuous, as suggested by recent Government figures of exportation, given in the following table:

Exports of Cotton (lint) from Peru.

Calendar Years —	thousand pounds —
1910	31,099
1911	35,026
1912	42,396
1913	52,731
1914	50,486
6915	46,573
1916	53,408
1917	38,306
1918	47,449
1919	87,551
1920	75,341
1921	30,306
1922	83,083
1923	93,470

The war years, and recurrent low prices, may account for adverse fluctuations in export trade.

J. H. H.

57. *Musanga Smithii* and its Value in Paper Manufacture.

THIRIET, A. Parasolier et papier de parasolier. *L'Agronomie Coloniale*, Year 10, No. 77, pp. 145-152, plates 7. Paris, 1924.

The author reviews the various reports from different countries relative to the fibre value of *Musanga Smithii*, and describes in detail the characteristics of the wood obtained in the Cameroons, and the subsequent treatment and quality of the paper obtained. The reports are favourable and the quality of the cellulose is considered equal to that of straw; a yield of 35-40 % is estimated. Treatment with bisulphite has produced a durable cellulose of good colour, with a yield of 50 %. It is estimated to obtain 25-30 % of superior fibre from the bark, and provided the economic conditions improve it is considered that *Musanga Smithii* should serve as a valuable source of raw material for the paper industry on the West Coast of Africa.

The plates illustrate clearly transverse sections of the wood.

M. L. Y.

58. Factors affecting the Protein and Oil Content of Soy beans.

STARK, R. W. *Journal of the American Society of Agronomy*, Vol XVI, No. 10, pp. 636-645, tables 6, bibliography. Geneva, N. Y., 1924.

The increasing use of soybeans, both as a feed for livestock and as a source of oil, led the author to make further investigations into the composition of the bean, as it had been observed that the composition varied when the plant was grown under different environmental conditions.

The following conclusions were arrived at as a result of the experiments:

An increase in yield of beans is frequently associated with an increase in protein content and a decrease in oil.

Applications of limestone and organic matter caused a marked increase in protein and the effect was further increased by the addition of rock phosphate. The addition of potash resulted in a decrease in the percentage of protein and an increase of oil.

The yield of oil in pounds per acre was increased by applications of organic matter. The addition of limestone caused a large increase in oil, but phosphorus and potash had little effect on the yield of oil per acre.

Wide variations may exist in the composition of the same variety of soybeans when grown in different localities.

Conditions which produce an increase in the percentage of protein result in a decrease in the oil content and *vice versa*.

Soybean oil may be used as a substitute for linseed oil in the manufacture of paint and varnish. The iodine number was found to differ according to the variety (121 to 139), but no consistent relation was found to exist between the iodine number and location or soil treatment.

W. S. G.

59. Varieties of Coconuts in Ceylon.

STOCKDALE, F. A. (Director of Agriculture, Ceylon). *Tropical Agriculturist* Vol. LXII, No. 4, pp. 204-209, 19 plates. Peradeniya, Ceylon, 1914.

The article gives a detailed description of nineteen types of coconuts, with external and internal dimensions, also the weights of the whole nut, husk, shell and meat. Photographic reproductions are given of each of the nineteen types, and particulars as to colour, size, shape of nut, relative amounts of kernel, shell and husk

The best types of nuts were brownish in colour, whereas green nuts were inferior.

Plants from each of the selected types have been put down on the estate of Mudaliyar A. E. RAJAPAKSE at Jaela, and at the Experimental Station, Peradeniya, for future investigations. W. S. G.

60. The Production of Vegetable Oils in Chile.

La producción de aceite vegetale en el país. *Boletín de la Sociedad Nacional de Agricultura*, Vol. LV, No. 5, pp. 352-357. Santiago, 1924.

According to the official reports for 1922, the importation of oils into Chile has been very extensive in recent years. Consequently steps have been taken to exploit the native resources and improve existing methods of oil extraction, and in general, to cope with the increasing demand.

A survey is made of the principal oleaginous crops and the average yield of oil: — olives, grape pips, linseed, soya, peanut, castor oil, rape, radish.

A description is given of the cleaning, decortisation and methods of extraction. varied to a certain extent according to type of seed. A special apparatus for hot pressure is employed, which proves very effective; full details of the process are given, with the subsequent treatment.
M. L. Y.

61. The Cultivation of Sumac (*Rhus coriaria*) in Spain.

JANINI JANINI, R. (Jefe de la Región Agronómica de Valencia). *Revista del Instituto Agricola Catalán de San Isidro*, Year LXXIII, No. 3, pp. 45-46. Barcelona, 1924.

The author points out the advantage which would ensue from cultivating this plant in the soils in which the reestablishment of vineyards presents difficulties and in which other crops are not possible owing to excessive heat, lack of moisture, etc. The plant is used in tanning and dyeing and is extensively cultivated in La Roda (Province of Albacete, the Mancha), which has poor soils and extremes of climate, and where there is a Society with an excellent installation, which has obtained yields 2 % higher than the largest establishments in Sicily, which have a good reputation. The inhabitants of the Mancha cultivate the male sumac in clayey soils and the female in lime soils, the leaves of the first giving 28 % of tannin and those of the second 22 %.

The Sicilian sumac yields more than that of the United States of North America, giving sometimes as much as 35 %.

The author describes the methods of cultivation and gives details of planting, labour, harvesting, transport and production. E. M. F.

62. Rubber Planting Questions.

DARBY, H. D. E. *India Rubber Journal,* Vol. LXVIII, No. 11, pp. 18-19. London, 1924.

In the article, the author, who has been rubber-planting since 1889, answers various questions on the growing of rubber.

The probable life for tapping purposes of *Hevea brasiliensis* when grown in the East, is probably not less than 50 years; there are thousands of acres in the Malay States from 20-25 years old which are still yielding. The life can be prolonged if the following precautions are taken: the planting area should be cleared of all jungle roots to a depth of 30 inches, below which fungoid root disease probably cannot exist. Only selected seed from healthy parents should be used. All precautions should be taken to retain the surface soil, by growing cover crops, or by other means. On flat land the soil should be aerated by digging.

The most satisfactory planting distance for trees is 25 × 25 ft., or 70 trees to the acre.

As regards tapping-systems: it is recommended that half the circumference of the tree be tapped daily at six-weekly or two-monthly alternations, and then resting for a similar period.

On young estates, where the land is flat, clean weeding is a good practice, but on slopes a cover-crop is advised.

With reference to disease: If the estate is cleared of all subterranean roots and timber there should be little fear of white ants or root disease. Disease of the trees above ground is largely a matter of supervision, and with competent mycologists at hand should not be dangerous. The most serious disease at present is " mouldy rot ".

For all-round estate work the Tamil is the best type of labour.

The majority of good properties in the East have up-to-date machinery, but large factory installations are costly in up-keep, and it is improbable that in future, new estates will erect such large installations. W. S. G.

63. Cover Plants for Rubber.

The Tropical Agriculturist, Vol. LXIII, No. 2, pp. 76-77, Plates 3. Peradeniya Ceylon, 1924.

The realisation of the serious effects caused by soil erosion has awakened interest in cover plants, indigenous specimens of which have been submitted to the Department of Agriculture for examination.

In the case of rubber there is need of some protection of the soil in the early stages, and green manure plants have been employed, such as

Crotalaria striata, and other small, shrubby plants; these protect the soil from the sun, but are not satisfactory in preventing soil erosion. To prevent soil erosion small creeping or prostrate plants are to be preferred, as erect-stemmed plants allow the surface water to cut channels between their stems. In the selection of plants, otherwise suitable, those should not be introduced which are difficult to eradicate.

Several species of *Phaseolus* appear to meet requirements; *Desmodium* sp. are being tried in the low-country, and *Cassia mimosoides* in the highlands.

To facilitate identification of the indigenous plants, illustrations and full descriptions are given in the article of *Desmodium triflorum*, *D. heterophyllum* and *D. heterocarpum*.

W. S. G.

64. The Present Status of Hevea Bud-Grafting.

The India Rubber World, Vol. XXX, No. 6, pp. 793-794. New York, 1924.

The article is a summary of the report of H. C. PINCHING, senior scientific officer of the Malaya Rubber Growers' Association, on his visit to Java and Sumatra, where he made a thorough investigation of the extent, results and possibilities of bud-grafting

In Java, bud-grafting has not been employed to any great extent, but in Sumatra 20 000 acres have been planted with vegetatively raised plants. On Malayan estates bud-grafting has not, as a rule, been taken up, except in the Kajang district where one estate has planted more than 1000 acres

Allusion is made to the work of Dr. CRAMER, of Buitenzorg, who is not yet prepared to advise bud-grafting on a large scale.

Results show that as a means of raising new plants the method is satisfactory, and that the extra cost should not exceed $15 per acre. A marked feature of bud-grafted trees is the cylindrical shape of their trunks, also, the similarity of trees raised from buds obtained from the same tree. Generally, the bark of such trees is thinner than that of seed-grown trees and the renewal of tapped bark is slower and poorer. Buds taken from high-yielding trees do not invariably give rise to high-yielding offspring, but sufficient data on yields have not yet been published to support or disprove the success of bud-grafting as a means of raising areas of high-yielding trees.

It is extremely difficult yet to estimate to what extent the high-yielding characteristic of a tree is due to the constitution factor, or the " environment " factor.

The author considers, that, for the present, it seems advisable to plant mixed bud-grafted and seed-selected plants, about 200 per acre, and then to remove the low yielders.

There is great similarity, as stated above, between trees belonging to the same clone, that is, raised from buds cut from the same tree, and some scientsits regard bud-grafting as a suitable means of isolating high-yielding clones, rather than as a direct means of obtaining material for planting estates. W. S. G.

65. Yield and Growth in *Hevea Brasiliensis.*

BRYCE, Dr. G. and GADD, C. H., *Department of Agriculture, Bulletin* No. 68, pp. 74, tables 50, bibliography. Peradeniya, Ceylon, 1924.

In a previous publication by the above authors data are recorded relative to 161 trees, raised from seed at Peradeniya. Certain relationships were found between yield and girth, cortex thickness, and number of of rows of latex vessels. It was considered desirable to repeat the investigations and to extend the scope of the work.

Considerable variation was found to exist in the yielding capacity of the trees, but those which gave the highest yields during the first year of tapping gave the highest yields in the second year, and similarly with girth, cortex thickness, and number of latex vessel rows in the cortex at 2 feet above ground level. It was also found that for the first year of tapping, trees giving the highest yields are also those with the greatest girth, most numerous latex rows, and thickest cortex. In other words, the character " yield " is interrelated with the characters girth, number of latex rows and cortex thickness.

The coefficient of correlation between yield for 1921-1922 and 1922-1923, indicates that generally the high yielding trees for the first year are also the high-yielders in the second year, and the low-yielding trees continue to give low yields.

It has been advocated that the best yielding trees are those with the highest number of latex rows. The authors' work showed that closer relationship exists between the yield of one year and that of the next, than between yield and any other character; hence, the selection of high yielders should be based on yield records. The operation of measuring girth is much simpler, speedier and less expensive than the determination of the number of rows of latex vessels of the cortex. As the correlation for characters girth and yield is higher than that for number of latex rows and yield, girth as an indirect measure of yield is to be preferred to characters of the cortex.

The application of the statistical method to agricultural experiments enables the worker to extract from the masses of figures their exact significance, together with the degree of reliability of the result.

As regards manures, the authors know of no experiment which has proved that their application directly increases the yield of rubber, although manures increase the growth and general vigour of the trees. It is concluded that yield is independent of vegetative growth.

Yield is an inherent character ; a tree is, in general, a good or a bad yielder and no special cultivation will change a poor into a good yielder. Cultivation in estate practice should therefore be directed towards the maintenance of trees in normal health and growth, to enable them to give the greatest yields that their inherent character renders possible.

W. S. G.

66. Rubber Tapping Experiments.

HOLLAND T. H. (Manager, Experiment Station, Peradeniya). *Tropical Agriculturist*, Vol. LXII, No. 4, pp. 195-198. Peradeniya, Ceylon, 1924.

An account is given of experiments carried out from 1919 to 1923.

Two-day tapping yields versus three day tapping yields. Three series of trees for each method were studied for 5 years and gave the following yields of rubber: alternate day tapping averaged 19.9 lb. for the 5 years (3.98 lb. per annum), whereas those tapped every third day yielded only 13.15 lb. Of trees tapped every two days, 5.8 % showed signs of brown bast disease, as compared with 1.1 % of the trees tapped every third day. No difference could be noted in the rate of bark renewal.

Comparison of V cut and single cut. Half the trees in this experiment were tapped with a single cut at 16° and half with a V cut, both on half the circumference, and tapped on alternate days throughout the year; 152 trees were tapped on each system. The results did not indicate any advantage in the V cut, as regards yield, which confirms experiments made in 1914.

W. S. G.

67. The Influence of progressive Applications of Nitrate of Soda on the Quality of Sugar Beets.

URBAN J. and SOUCEK (Institut der Csl. Zuckerindustrie). Ueber die Wirkung gesteigerter Chilisalpetergaben auf die Qualitat der Rube. *Zeitschrift für die Zuckerindustrie der Cecoslovakischen Republik*, Vol. XLVIII, No. 48, pp 449-456. Prague, 1924.

The trials were carried out on experimental plots, treated with top dressings of nitrate of soda in amounts equivalent to 100, 200, 300, 450 kg. per hectare. It was ascertained that the first 100 kg. increased the yield per hectare by 1800 kg.; with the second 100 kg. of nitrate an increased yield of 1600 kg. was obtained; with the third an increase of 1500 kg; and with the last 150 kg. of nitrate an increase of 500 kg. The sugar value of the beets treated with 100 and 200 kg. of nitrate was the same as that of untreated plants; the stronger doses of 300 and 400 kg. reduced the sugar content by 0.1 to 0.2 % while the purity of the juice was diminished by 0.3 %. The sugar yield per hectare was increased by 320, 320, 250, 80 kg. respectively, according to the amount of the dressings. The total nitrogen content increased by 2, 4, 8 and 10 % respectively.

These results are not of general application to all types of soils. In certain cases the effect of the treatment was most unfavourable, the sugar value being reduced by 0.75 %; elsewhere the quality of the beets treated with nitrate was the same as that of untreated plants. Where the yield on untreated plots was already abundant, the addition of nitrate reduced the sugar content and the purity of the juice, while the amount of nitrogen was increased. On the poorer soils, however, the nitrate exercises a beneficial influence not only upon quantity but also upon quality.

A. F.

68. The Yield from Sugar Beet in Colorado.

JARREL, J. F. The Beet Stand, and Losses in Yield. *Louisiana Planter and Sugar Manufacturer*, Vol. LXXII, No. 25, p. 493, New Orleans, 1924.

Experiments carried out at Longmont Experiment Station College show that the best spacing for the development of a sugar beet is about 240 sq. inches or 26 133 plants per acre. In practice this stand is equivalent to 100 beets in 100 feet of row, if the rows are 20 inches apart.

The Longmont Station, since 1914, has weighed about 500,000 beets, the average weight per beet being 1.27 lb., which with the above spacing would give a theoretical yield of 16.596 tons per acre. In 1923, in Colorado, the actual yield obtained from over 90 000 acres was 16.914 tons per acre, which is very near to the Longmont figure. However, the average for Colorado during the past 8 years is only 11.33 tons per acre, or less than 70 % of the yield assumed to be possible by the Longmont investigations.

There is no doubt that spacing materially affects the yield and that close supervision at thinning time will repay the farmer. W. S. G.

69. Selected Coimbatore Canes in Growers' Fields in North Bihar.

SAYER, W. *Agricultural Journal of India*, Vol. XIX, No. 5, pp. 493-499. London, 1924.

As a result of through testing at Pusa the seedlings Co 210, Co 213, and Co 214, were found to be superior to the canes grown in North Bihar in tonnage, sucrose content and freedom from disease. Seed-cane from these varieties was distributed in 1923 to growers who were asked to report their experience with these canes.

From the reports received it is seen that the Coimbatore seedlings have shown their superiority, under similar conditions, over the local cane in the growers' own fields. Co 213 is preferred both by growers and sugar factories. It is easily first in tonnage, second in sugar and lowest in fibre. The three canes are now well established in North Bihar, and at Pusa investigations are being carried out as to their ratooning qualities.

Since the above was written, further reports have been received from the growers, who state that the Coimbatore seedlings, although planted on soil deficient in moisture, have successfully withstood the exceptionally hot weather and are now far ahead of the local canes.

W. S. G.

70. Summary of Experiments on Sugar Cane, Soils, etc.

EASTERBY H T. and PATTEN G. R., *Bulletin No. 4, Bureau of Sugar Experiment Stations*, pp. 94. Brisbane, Queensland, 1924.

The *Bulletin* contains an account by the Director and Analyst of the Department of Agriculture, on experiments with sugar cane and on soil treatment, and soil and other analyses, carried out from 1902 to 1923. The value of deep subsoil-ploughing was shown, the increase of cane per acre being 19.8 tons, and of sugar per acre 2.8 tons ; a similar increase was shown by the ratoon crops. Mixed manure (nitrogen, potash and phosphoric acid), 6 cwt per acre, gave increases in yield of both cane and sugar. The addition of lime, up to 6 tons per acre, to red soils did not produce a satisfactory increase.

Cane planted in rows 4 feet apart gave 20 tons per acre more cane than when the rows were 7 feet apart, and the yield of sugar was also greater with the closer planting. W. S. G.

71. Cultivation of Sugar Cane in Queensland.

EASTERLY, H. T. (Director, Bureau of Sugar Experiment Stations). *Bulletin* No 3 (Revised Edition). *Queensland Bureau of Sugar Experiment Stations*, pp 48, plates 13 Brisbane, 1924

The Bulletin treats the subject under the following main heads: Taking up virgin scrub lands, forest lands, clearing and planting, cane cultivation on old lands, irrigation and manures, varieties, analytical data, weather conditions, pests and diseases The Bulletin concludes with brief descriptions of the sugar districts of Queensland, for the assistance of prospective growers. W. S. G.

72. Nipah Palm and Sugar Content of Juice in connection with Alcohol Manufacture (1).

EATON, B. J. and DENNET, J H Further Reports on the Nipah Palm. *The Malayan Agricultural Journal*, Vol XII, No. 6-7, pp 154-162, tables 5 Kuala Lumpur, 1924.

Report of the tapping experiments made in Malaya with estimates of the sugar con tent of the juice of the Nipah palm, and an investigation made in connection with the disappearance of alcohol from the juice after standing for some days.

A catch drain was made round a group of palms to ascertain whether any changes in yield were forthcoming. Results indicated that the yield is greatly increased by keeping a permanent supply of water round the roots of the palms. It was observed that juice is obtainable for the whole twelve months of tapping, at an average rate of 1 quart per palm per day It has still to be determined if these yields can be maintained in consecutive years.

The analyses demonstrated the variability of the sugar content of the juice. For palms giving normal yields, the calculations indicate an average of 5-6 ounces per day, with the exception of the commencement and end of tapping. As regards the keeping properties of the preserved juice, the results show the value of sulphuric acid to prevent premature fermentation if the alcohol is to be used for specific yeasts, although in the manufacture of sugar, the acid is not advisable owing to the production of invertose. Further investigations are in progress. M. L. Y.

73. The Yield of Budded Cacao.

HARLAND, S. C. *Tropical Agriculture*, Vol. 1, No. 5, pp. 66-69. Trinidad, 1924.

Report of a series of experiments with budded and grafted cacao made by the Trinidad Department of Agriculture at River Estate.

(1) See *R.* 1923, Nos. 112, and 492. (*Ed.*)

The results indicate that there is no correlation between the yield of the parent and the mean yield of its budded offspring. Consequently the value of a tree for budding purposes can only be estimated from the mean yield of its budded offspring. Taking into account the variability of soil and growth conditions it has, however, been noted that the low yield is not due to environment, but is inherent. The analysis made of a block of trees demonstrates this clearly. Certain trees although high bearing individually, may produce budded offspring of low yielding capacity, entirely of an inherent nature.

The author discusses the yield of cacao relative to the development of the tree and the physiological causes of high and low yield and subsequently, the possible effect of vegetative reproduction on each of the main stages of productivity. Reference is made to the effect of budding on the shedding of young fruits of cotton, and on the yield of rubber, and it is suggested that the physiological condition of the stock and type of root system is the predominating factor in the setting of fruit and that due consideration should be given to this fact in vegetative propagation. The bud grafting rubber tests made in the Dutch East Indies and elsewhere confirm the foregoing conclusions, and observations on grafted apple trees have given similar evidence. M. L. Y.

74. *Salvia Spinosa*, a Useful Aromatic Plant in Cyrenaica.

CAVARA, F Una salvia da essenza della Cirenaica *Profumi italiani*, Year II, No. 2, pp 29-31, figs. 3. San Remo, 1924.

In ancient records frequent references have been made to *Salvia Sclarea* and other *Salvia* species, and according to observations made at the Botanic Gardens, Naples and elsewhere, the so-called *Salvia spinosa*, common in Cyrenaica, corresponds very closely with certain of these species. Until now the plant has only been considered of interest from the botanical standpoint, quite apart from any possible commercial value.

A distinct similarity exists between this species and *S Sclarea*, a plant well known for its perfume This, fact, combined with facility of cultivation and adaptability to dry climates, should encourage the cultivation of *S. Spinosa* in the future. M. L Y.

Horticulture and Arboriculture.

75 Relation between the Composition of Californian Cantaloupes and their Commercial Maturity.

CHACE, E M, CHURCH, O. G, and DENNY, F E (Laboratory of Fruit and Vegetable Chemistry) *United States Department of Agriculture. Department Bulletin* No 1250, p 27, fig 2 Washington, D. C., 1924.

The aim of this study is to establish certain facts that would assist agriculturists and exporters in judging of the ripeness of cantaloupes, so that the ripe fruit only should be picked first. Results obtained show that as cantaloupes ripen, they contain a larger quantity of solid substances and of saccharose, and that the refractive index of the juice increases, while the percentage of starchy matter in the seeds is lessened.

The sap of cantaloupes gathered when ripe, has a specific gravity of at least 1.040 (equal to 10 % of solid matter) and a refractive index of at least 55 and contains at least 4.5 % of saccharose. The seeds of the ripe fruit contain less than 5 % of starch.

When gathered, cantaloupes gain in perfume but not in sweetness. If preserved at low temperatures, as in refrigerators, the fruit undergoes little alteration, so that the composition after storage appears to be the same as at the time of gathering. When softened at ordinary temperatures, only a small quantity of saccharose is lost. After gathering however, the loss of starchy matter in the seeds is maintained. A. F.

76. The Propagation and Cultivation of Citrus Trees in Egypt.

BROWN, T. W. *Ministry of Agriculture, Egypt, Technical and Scientific Science Bulletin*, No. 44, pp. 1-88, plates 33. Cairo, 1924.

This book gives a comprehensive account of citrus growing in Egypt. The work includes details of propagation, care of seedlings, care of young plants in the grafting, budding, choice of stocks, planting, planning the orchard, cultivation, diseases and pests, description of varieties. Reference is made to the importance of windbreaks which consist of evergreen trees such as *Casuarina*, *Eucalyptus*, Cypress and Sycamore On no condition should trees such as *Eugenia Jambolana* and *Ficus retusa* var. *nitida* be used, as these are usually infested with scale insects. This applies also to mango trees which are infested with orange scale To protect from the sun's rays, it has been recommended to plant *Poinciana* at intervals of 28 metres.

As an effective hedge, *Caesalpinia sepiaria* and *Aberia Caffra* are mentioned. M. L. Y.

77. The Pollination of Cherries applied to Commercial Cherry Growing.

HOOPER, C. H *The Journal of Pomology and Horticultural Science*, Vol III, No. 4, pp. 185-190. London, 1924.

Observations based on pollination trials with early, mid-season, and late flowering varieties of cherry, 1912-1923. Attention is drawn to the importance of noting the average length of time in full flower, in conjunction with the relative order of flowering, when grouping trees in the orchard. M. L. Y.

78. The Seedless Breadfruits of the Pacific Archipelagoes.

WESTER, P. J. *The Philippine Agricultural Review*, Vol. XVII, No. 1, pp. 24-39. Manila, 1924.

This list of breadfruits grown in the Pacific Archipelagoes has been compiled to make available the scattered information on this subject, and to show the remarkable number of forms that have been envolved. All the varieties are seedless unless otherwise indicated. M. L. Y.

Forestry.

79. Pencil Cedar from East Africa.

Journal of the Royal Society of Arts, Vol. LXXII, No. 3751, p. 818. London, 1924.

The timber resources of Kenya Colony have recently been surveyed by the Government, and it is considered that at present it would not be profitable to export either hewn or sawn timber of ordinary kinds, as the areas of supply are hundreds of miles inland. However, a wood known locally as "mutarawka" (*Juniperus procera*) is thought to be suitable for pencil cedar, of which the usual type is said to be fast disappearing. The wood is a handsome reddish brown, soft wood, with fine even grain, rather brittle, aromatic, and cuts easily with a knife. It is estimated that sufficient supplies are available to keep up a sustained export in pencil slats until such time as reafforestation timber will be ready for exploitation. Mutarawka is found in the highlands and is shipped from Mombasa. W. S. G.

80. The Blue Gum (*Eucalyptus globulus*). Notes on its Physical Qualities, Conversion and Uses.

SCOTT, M H *The South African Journal of Industries,* Vol. VII, No. 9, pp. 576-578, figs. 3. Pretoria, 1924.

Reports of the experiments made at the Pretoria Seasoning Kilns on locally grown blue gums (*Eucalyptus globulus*). The author discusses the physical properties and draws attention to the variation in weight; the average was found to be 48 lbs. per cub. ft., oven dry, but as much as 35 5 lbs. difference was noted between the maximum and minimum weight. This variation occurred in the same tree. The specific gravities vary from 1.10 to 0.52 (=68.0 and 32.5 lbs. per cub. ft. respectively).

Recommendations are made with reference to sawing and prevention of splitting and casting, or sideways warp. It is preferable to saw down the centre first and then to cut at right angles to the original cut.

As regards loss in conversion, i. e. cutting boards to size from the log in the round, taking the total shipment as 100 cub. ft., 38 % was accounted for by slabbing and 12 % by saw-dust, allowing 7.5 % for defects and 4.7 % for shrinkage.

Hitherto this wood has been considered to be almost impossible to season and, consequently, suitable only for rough work. The seasoning kiln tests have, however, demonstrated the practicability of stack drying and air drying, in winter or late autumn, but more especially by artificial seasoning. A detailed description is given of this last method. The cut boards were placed part in a water spray kiln and part in a fan kiln. The time taken to season was 52 and 31 days respectively. No further splitting took place in either kiln during the drying process, and defects were negligible.

Examples of flooring with wood thus seasoned show the value of the process and the time saved. M. L. Y.

81. The Saligna Gum (*Eucalyptus saligna*). Its qualities and Uses.

SCOTT, M. H. (Forest Department, Pretoria). *The South African Journal of Industries*, Vol. VII, No. 8, pp. 504-506. Pretoria, 1924.

Nearly all the indigenous forests of South Africa produce hard woods, not easily worked, or suitable for use in general construction work. *Eucalyptus saligna* has been introduced and will in time supply a part of the country's soft wood requirements.

When first cut the wood is pinkish-white and the heart not easily distinguished from the sap; afterwards the heart darkens and the sap turns a greyish-white.

The wood is softer and less dense than most gums; it nails and glues well and polishes easily. The weight when dried averages 36 lb. per cubic foot, but when freshly cut may reach 70 lb.

As with all other varieties of *Eucalyptus*, there are in the living tree strong internal stresses, which when the tree is cut are freed to a certain extent and cause splitting. The waste from this cause is from 10 to 20 %. *Eucalyptus saligna* has been successfully seasoned artificially.

W. S. G.

LIVE STOCK AND STOCK BREEDING.

General.

82. The Eggs of Tuberculous Fowls as a means of Transmitting Avian Tuberculosis.

FITCH, C. P., LUBBEHUSEN, R. E., DIKMANS, R. N Report of experiment work to determine whether avian tuberculosis is transmitted by the eggs of tuberculous fowls. *Journal of the American Veterinary Medical Association*, Vol. XVI, New Series, Vol. 19, No. 1, pp. 43-53, bibliography. Detroit, 1924.

Avian tuberculosis has become very important, not only on account of the development of aviculture but because of its connection with the tuberculosis of other domestic animals. It is generally admitted that avian tuberculosis is transmitted by the excrement of infected fowls; it has also recently been asserted that the eggs of those affected with tuberculosis constitute a means of dissemination.

After having referred to the investigations and results arrived at up to the present day, the authors give the results of their own investigations.

They utilised 62 fowls, of which only 43 laid, which implies that about 30 % of tuberculous fowls, in all stages of the disease, produce no eggs. 876 eggs were examined; 367 by the Erlenmeyer method of flask culture and 509 by inoculations in guinea pigs. The tuberculosis germ was found in a group of 9 eggs coming from 2 different fowls.

It may therefore be safely concluded that less than 1 % of the eggs laid by tuberculous fowls contain live tuberculous bacteria. The authors have shown that chicks may be hatched by incubating infected eggs and that it is possible for an egg naturally infected, to give birth to a tuberculous chick. It is however absolutely denied that this can take place in practice and be of a nature to cause an active dissemination of the disease.

The authors have also examined the shells of 209 eggs laid by fowls recognised as tuberculous and sullied by excrement. The shells were carefully washed in a sterile saline solution which was afterwards centrifuged: the sediment was injected in fowls intraperitoneally: in no case did the injection cause tuberculosis

The general conclusion may be drawn that the egg plays no important part in the transmission of avian tuberculosis. P. D.

83. The Effects of Adding Vitamine-Rich Substances to Normal Rations for Poultry.

ORR J B, CRICHTON, A and NORTH, B M (Rowett Institute); KINROSS, A (West of Scotland College of Agriculture); MOIR, M (North of Scotland College of Agriculture); NEWBIGGIN, H (East of Scotland. College of Agriculture). *The Scottish Journal of Agriculture,* Vol VII, No. 3, pp. 266-277, tables 12. Edinburgh, 1924.

I. Results of various tests made at the aviculture sections of the "Rowett Institute" and the 3 "Scottish Colleges of Agriculture", to determine whether the use of vitamine-rich substances give results of any economic value when added to the normal ration of fowls bred for profit under ordinary practical conditions. The authors first mention the results obtained in previous investigations and then give in detail the tests carried out simultaneously in 4 centres, to determine the effect of adding cod-liver oil to the normal, rations on (1) growth, (2) laying, (3) hatchability. In the various cases in question care was taken to have the members of each lot comparable in point of breed and age; in addition they were all closely related.

(4) Growth tests.

Test I (Rowett Institute): 2 lots of 6 Leghorn chicks; each lot had a cage (1.8 × 1.2 m.) with wooden floor and sawdust litter. The cages are kept in a well-lighted room but the birds are not exposed to the direct action of the sun's rays.

Ration: Wheat and oat meal, paste composed of maize + bran + oat flour + fish meal + bone meal (4 : 4 : 4 : 2 . 1), gravel and water, always within reach of the birds, which also receive 5 cc. of mangel juice per head per day.

Lot 1 : 5 cc. of cod-liver oil per head per day mixed with the paste.

Test II (East of Scotland College of Agriculture) : 2 lots of 10 Anconas, in fowl-houses with open-air run on bare earth of 184 m².

Ration : Wheat and maize meal : paste composed of bran, crushed oats, middlings, fish meal, dried yeast, maize flour (12 : 12 : 12 : 2 : 1 : 1). Grit and water.

Lot I : 1 cc. of cod-liver oil per head per day.

Lot II : 1 cc. of linseed oil per head per day.

Test III (West of Scotland College of Agriculture) : 3 lots of 70 White Leghorns aged 7 days at the beginning of the test. Ration composed of grain and grain by-products, plus milk for 14 days, afterwards replaced by fish meal. Lot I received at first $^1/_5$ cc. of cod-liver oil per head per day ; at the end of 6 weeks this was increased to ½ cc.

Lot II an equal quantity of linseed oil.

Lot III, no oil.

Table showing results of growth test.

	Average weight at beginning of test	Average weight at end of test	Daily average gain per head 90 days	Daily average gain per head 230 days
	grams	grams	grams	grams
Rowett Institute.				
Cod-liver oil Lot	411	1183	8.6	—
Linseed oil Lot	521	1489	10.7	—
Edinburgh.				
Cod-liver oil Lot	615.7	1475.8	9.6	5.00
Linseed oil Lot	613.8	1438.6	9.2	5.04
Kilmarnock.			48 days	
Cod-liver oil Lot	31.1	342.4	6.5	—
Linseed oil Lot	34.0	365.1	6.9	—
No oil.	34.0	367.9	7.0	—

In every case the birds were in excellent condition at the end of the test period. The above results afford no proof that the addition of cod-liver oil to the normal ration is attended with favourable results on the growth of chicks. This coincides with the results obtained by KNOX and LAMB at the " Iowa State College " (1924). These Authors utilised cod-liver oil and butter as soluble vitamine sources. They obtained the following results (see page 187).

The addition of vitamine-rich substances to a normal ration does not increase growth. On the contrary, chicks receiving fats seem ailing and their records are below those of the checks.

B) Laying tests.

Test. IV. 4 lots : 2 of 12 fowls and 2 of 9, the Leghorns having a grass plot.

	Initial weight	Weight after 8 weeks	Grams of food per gram of gain in weight
	gms.	gms.	gms.
Test I.			
Check lot, no oil	42.5	103.8	5.38
2 % of cod-liver oil	40.5	169.0	5.55
Test II.			
Check, no oil	35	189	4.25
2 % of cod-liver oil	35	178	4.46
Butter (2 % of the ration).	34	142	5.02

Ration : equal parts of wheat, oats and maize siftings ; paste ; bran, middlings, crushed oats, pounded maize, fish meal (4 : 4 : 3 : 3 : 2). Lot A 5 cc. of cod-liver oil per head per day. Lot C 5 cc. of linseed oil per head per day. Lots B and D no oil

Test V. 4 lots : 2 of 5 Leghorn pullets and 2 of 5 Leghorns aged 2 years.

Ration : Paste : bran, middlings, maize, fish meal (2 : 2 : 1 : 1), 42.5 gm. of grain and 2 cc. of mangel juice per head per day. Water and gravel *ad lib*

Lots A and C 5 cc. of cod-liver oil per head per day.

Test. VI. 2 lots of 10 Anconas, same ration as in V.

Lot A 1 cc. of cod-liver oil per head per day.

Lot B 1 cc of linseed oil per head per day.

The test covered the period from September to June.

Test. VII. 3 lots of 12 Leghorn pullets having a grass run. Test lasted from October 1922 till May 1923.

Ration : Meal, maize, wheat, oats, paste : bran + fish meal + middlings, + maize flour, + crushed oats (3 : 2 : 3 : 3 : 3).

Lot B received 5 cc. of cod-liver oil per head per day, lot C. 5 cc. of linseed oil per head per day

Test. VIII. Made in the winter of 1923-4 with 2 lots of 20 Leghorn pullets.

Ration : Maize + wheat + oats ; paste : bran, flour, crushed oats, maize flour, fish meal (1 : 1 : 1 : 2 : 2). Grit and water *ad lib.*

Lot II received 2 cc. of cod-liver oil per head per day.

Lot III 2 cc. of linseed oil per head per day.

In column A the effects of adding cod-liver oil and linseed oil are compared and it seems to follow from the results obtained that the vitamine-rich cod-liver oil has no higher stimulating effect on laying than the vitamine-poor linseed oil.

In columns B and C the effects of adding cod-liver oil and linseed oil to a normal ration are given ; results show that with the dose used these two oils have a tendency to diminish egg production.

In conclusion it may be said that if vitamine A is necessary for laying, the ordinary rations normally contain a sufficient quantity and the addi-

Average number of eggs per fowl in the laying tests.

A			B			C		
Test	Cod-liver oil	Linseed oil	Test	Cod-liver oil	No oil	Test	Linseed oil	No oil
V . .	20.6	21.6	IV	47.6	53.2	IV	53.0	52.1
VI .	86.0	85.6	VII	123.5	143.6	VII .	121.8	143.6
VII . . .	123.5	121.8	VIII	93.4	97.5	VIII .	95.2	97.5
VIII . .	93.4	95.2						
	323.5	324.2		264.5	294.3		270.0	293.2

tion of cod-liver oil to a normal ration seems rather to diminish than to increase egg production.

(C) Incubation tests.

Made in order to determine whether cod-liver oil influences hatchability. Eggs from the laying tests were used The results given below show great variations in the percentage of eggs hatched but this is due to incubation factors Though the results are not uniform, nor in accord with those of the laying tests, they nevertheless lead to the conclusion that hatching vigour is not increased by the addition of vitamine-rich cod-liver oil to an ordinary normal ration.

Incubation tests

	No of eggs placed in incubator	No of eggs fertilised	Percentage of eggs fertilised	
			Hatched	Died in shell or addled
Test VI (eggs)				
Lot A (cod liver oil)	49	36	34.3	65.7
Lot B (linseed oil)	25	18	33.3	66.7
Test VIII (eggs from)				
Lot A (no oil)	50	28	92.9	7.1
Lot B (cod liver oil)	50	37	75.7	24.3
Lot C (linseed oil) .	50	37	86.5	13.5
Test V (eggs from)				
Lot A (cod liver oil) .	26	—	57.7	42.3
Lot B (cod liver oil)	26	—	84.6	15.3
Lot C (linseed oil)	26	—	57.7	42.3
Lot D (linseed oil)	26	—	69.2	30.8

It may be concluded in general from the various tests that the addition to an ordinary ration of vitamine-rich cod-liver oil has not proved economically profitable, which shows that the ordinary ration contains a sufficient quantity of the necessary vitamines. P. D

84. Silage Feeding Investigations.

McCampbell, C. W., and Horlacher, W. R., *Agr. Exper. Stat., Kansas State Agricultural College, Department of Animal Husbandry, Circular* 105, pp. 10, fig. 1. Manhattan, Kansas, 1924.

A first experiment was carried out to decide the quantity of cotton oil-cake that might economically be added to a ration of shelled maize, of sugar cane ensilage fit for fodder, and of lucerne hay, for the fattening of young bullocks. Fifty Hereford cattle of the first generation were divided into 5 lots as similar as possible with regard to size, type and quality. In a 6th lot were placed 10 heifers of the same breed. Before the experiment the animals received sugar-cane ensilage and lucerne hay. In the course of the trial the animals had salt and water continually at their disposal and received a basal ration composed of shelled maize and sugar-cane ensilage at their free disposal, besides 200 gms of lucerne hay per head per day. In addition they were given the following quantities of cotton cake per head per day: Lot I, nothing, Lot II, 225 gms; Lot III, 453 gms., Lot IV, 675 gms, Lot V and VI, 905 gms.

In a table, details are given of the results of the experiment, which are shown graphically and from which the following conclusions may be drawn: -

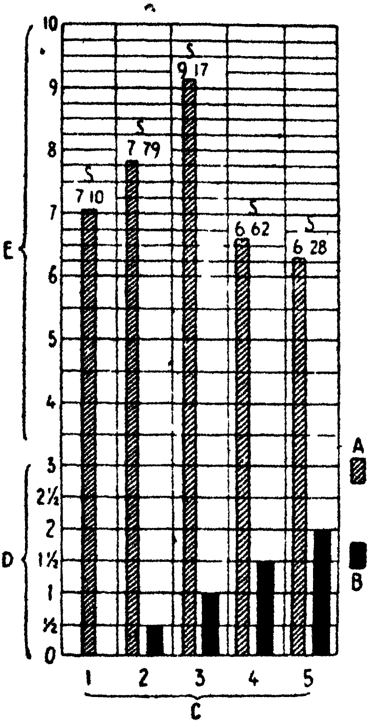

Fig 62 — Average Medium gain per head for steers each group (in dollars) and quantity of cottonseed cake (in lbs) fed per head daily

A (crosslines) = gain
B (black) = quantity of cake
C = number of groups

(1) A fattening ration for young beasts composed of maize, ensilage and lucerne hay is economically completed by the addition of 450 gms. of oil-cake per head and per day. A greater quantity is not more profitable, under present market conditions of food stuffs and cattle.

(2) Cotton cake stimulates the appetite.

(3) It is not always the animals that gain most rapidly, nor those whose ration costs most, that obtain the most benefit. It is important to combine the foods in such a manner as to obtain the most rapid gain in weight and the highest degree of fattening, with the minimum of expense.

(4) Heifers put on weight as rapidly as young bullocks and

are generally in better condition at the end of a given fattening period.

A second experiment was made to verify the often expressed opinion that cattle fed during the winter with ensilage do not thrive as well at pasture the following season.

For this purpose two lots of young bullocks were set apart, which received in the course of the winter, the one lucerne hay, and the other ensiled fodder and 450 gms. of cotton cake per head per day. During the summer all the animals were put out to pasture. The trial was continued during 3 winters and 3 summers.

The following conclusions were drawn:

(1) Ensiled fodder completed by 450 gms. of cotton cake per head per day, and lucerne hay, constitute two suitable winter rations. The choice depends entirely on which is available and on the price.

(2) The gain in weight realized by the young bullocks at pasture depends more on their condition at the time of putting out to pasture, than on the kind of food consumed during the period of the previous winter season.

(3) Lean young bullocks at pasture gain as much weight during the months of May and June as during all the rest of the period of pasturage.

A 3rd experiment was made to judge of the effect produced by finishing fattening with concentrated foods, after a period of pasturage. The conditions of feeding were identical with those of experiment No. II, but after 60 days of pasturage the animals were brought in and fed during 83 days with ensiled fodder, lucerne hay, and ground maize. Notwithstanding the defective conditions of transport to market, and in spite of the high price of concentrated food stuffs, the result of fattening with these food stuffs enabled us to gain a higher profit of 14-16 dollars per head than that obtained from bullocks sold directly after pasturage, without finishing fattening with concentrated food stuffs. P. D.

85. Olive Residues in Sheep and Pig Feeding.

GOUIN. Les grignons d'olives dans l'alimentation des moutons et des porcs. — *La Vie agricole et rurale* Year 13, Vol. XXV, No. 39, p 218. Paris, 1924,

When the oil is extracted from pressed olives, there remains a pulp residue known as 'olive feed' which possesses rich nutritive qualities owing to its high content in oil. In this condition, it can only be given to cattle in very small quantities so as to avoid an overloading with fatty proteins which might cause intestinal and digestive troubles. Moreover this fat, oily substance, being liquid acts on and softens the fatty tissues, thus depreciating the quality of the lard in the case of pigs. The cellulose of the hard gritty fragments of the olive-stones makes digestion difficult and may, in the long run, cause irritation of the intestines.

Often, the residue from the first pressing of olives is again crushed and kneaded in water: the pulp, and fatty matter, which rises to the surface is boiled and pressed and thus a kind of cake is produced much appreciated by sheep but which quickly turns sour and should be fed in combination with bran or coarse meal. This cake treated with carbon di-sulphide gives a cake which can be fed in small quantities to ruminants and pigs but is not easily assimilated.

In short, these by-products of olive pressing supply a poor quality of food which can be given to sheep in small quantities, provided their ordinary ration is well supplied with proteins.

Components of olive residues after extraction of oil

	Olive residues	Olive cake	Extracted olive cake
	%	%	%
Water	27–30	14	8
Nitrogen	3–4	6	10
Fat	14–15	29	11
Nitrogen Free Extracts	29–32	42	57
Cellulose	16–23	6	8
Mineral substances	2 3 5	2.5	5

P D

86. The Use of Locusts in the Feeding of Animals.

I THERON, J J and HALL, T D (Potchefstroom School of Agriculture) The toxicity of locusts poisoned with arsenical baits. *Journal of Department of Agriculture, Union of South Africa,* Vol VIII, No. 6, p. 626-7 Pretoria, 1924.

II LITTLE, A Locusts and locust meal as poultry food. *The Rhodesia Agricultural Journal,* Vol. XXI, No. 3, p 334 Salisbury, 1924.

1. Experiments carried out in order to determine the toxicity of locusts poisoned with arsenical baits and liable to be eaten by animals, or distributed to them in food. The bait was made up of 2 oz. of soda arsenite containing 80 % of white arsenic, 2 lb. of sugar, 2 gallons of water and $^1/_2$ sack of barley or bran.

Tests were carried out on lots of 50 locusts and in eight of such determinations only 0.1 to 1 mgm. of arsenious oxide was found in a batch; 750 of the air-dried locusts weighed approximately one pound and would therefore contain a maximum of 15 mgm. of white arsenic.

In practice, except in cases of animals possessed of extreme susceptibility to arsenic, locusts poisoned by means of bait made according to the given directions may be used safely as a feed for cattle, horses and even sheep. Pigs being more sensitive to poisons, should not be fed in this manner. As regards poultry, they would hardly be able to eat a sufficient quantity of locusts to feel any of the poisoning effects.

[86]

Doses of arsenic fatal to full-grown animals.

	Weight of arsenic having fatal toxicity	Weight of air dried locusts containing a toxic dose
	gm	lb.
Cattle .	3 – 10	200 – 700
Oxen .	1 – 3	67 – 230
Horses	0 5	30

On the other hand, should the bait used contain a higher percentage of arsenic than that prescribed, the poisoned locusts would constitute a danger.

The authors cannot recall any cases of poisoning when baits were prepared according to the prescribed directions and in the given proportions

II. The author points out the various advantages to be derived as regards cost of production and increase of egg-laying, from feeding poultry on locusts or locust meal The meal is not costly to manufacture and is easily prepared, the locusts being collected in sacks, scalded, dried in the sun, and reduced to powder, which is then mixed with dry food at a rate not exceeding 5 ½ %.

Comparative nutritive value of locust meal.

Foods	Protein	Moisture	Carbo hydrates	Fat	Fibre	Mineral matter	Nutritive ratio
Locust meal	59.60	9.05	3 78	11 19	11.26	5 12	1 – 0.5
Meat meal	71.20	10.07	0 30	13 70	11.26	4 10	1 – 0.4
Fish meal	48.40	10 80	0 30	11 70	11 26	29 20	1 – 0.5
Fresh milk .	3.40	87 10	4 75	3 90	11.26	0 75	1 – 4.0
Skimmed milk	3 57	90 50	4 95	0 10	11 26	0 78	1 – 1.4

P. D.

87. Slaughter-House-Blood in Animal Feeding.

C V. *Revue de Zootechnie, La Revue des éleveurs,* Vol 3, No 9, pp 164-165. Paris, 1924.

Blood, because of its constituents, is representative of the animal organism and because of its wealth in nitrogenous matter can, as a food, be of great service in cases of intensifive production. On the other hand, it is liable to promote disease, putrefies rapidly, and is very difficult to preserve.

Dr. GAUDUCHEAU makes the following suggestion for the treatment of blood: Vinegar and sugar should be added at the time of collection at the slaughter-houses, also an alcoholic yeast (Saccharomyces) should be mixed with it, and the blood should then be kept at the most suitable temperature for preservation.

Active fermentation starts at once, producing a substance of distinctive and pleasant taste, and having satisfactory preservative qualities. As there is no heating, the contained protein, diastase, and vitamins remain intact.

Blood treated in this manner is a satisfactory product and very nutritious. Young rats fed on it in the proportion of 1 to 20 in their daily ration, developed two or three times more rapidly than others not so fed, their increase in weight was 20 to 30 gm. per head and per day, whereas that of the others was only 10 gm.

It should be noted that the stimulating action on growth does not continue after the first week, but the progress achieved is maintained; this is easily explained by the fact that, when blood has supplied a sufficient quantity of amino-acids, iron and vitamins, that were lacking, or were present in insufficient quantities in the ordinary ration, its use ceases.

P. D.

88. Effect of Climate on Fecundity.

WOLDA, G, Akklimatisierung und Deklimatisierung. *Genetica*, Part V, Nos 5-6, pp 497-526, tab. 2. The Hague, 1923.

The varying fecundity of individuals is affected by climate and growth factors, which have also given rise to differences among the various species. This is particularly well-known in the case of birds and may be studied ecologically. A species which prolongs its laying period becomes acclimatised, one which shortens it becomes declimatised. The variation in the number of eggs laid is in its turn related to the longer or shorter laying period, which in turn is related to the more or less complicated structure of the nests.

The Author is also trying to discover whether in correlation with age, there is not also in the human species a different periodicity in births.

G. B.

89. Sex of Long-Carried Calves.

HOOPER, J J. (Kentucky Experiment Station). *The Breeders' Gazette*, Vol LXXXVI, No. 13, p 281, Chicago, Ill., September 25, 1924.

It is a widespread belief among farmers that male sex is predominant among long-carried calves.

In order to reach a definite opinion on this point the author has studied the records of the Kentucky station herd with respect to about 500 pregnancy periods noted during the last 30 years; 44 cases out of this number exceed the normal period of pregnancy (283 days), by 7 to 17 days, and of the 44 long-carried calves born, 25, i. e., 59 %, were males and 19, i. e. 41% females. This would therefore be a ratio of 4 females to 6 males.

P. D.

90. Cross-breeding of the First Generation in Poultry-Rearing.

LEGENDRE, G. *La Revue de Zootechnie* (Stock Breeders' Review), Year 3, No. 8, pp. 144-148. Paris, 1924.

In poultry farming it is not the laying of eggs alone that provides profit. Numerous factors contribute to it, amongst which should be named, besides abundant egg-laying during the winter season, early development, sexual precocity, size of eggs, vitality of embryos and young birds, adaptability to various external conditions, ability to obtain nourishment from the food supplied, etc.

Mixed breeds, therefore, undoubtedly possess valuable qualities, especially in regard to the last features.

In order to bring about an equal distribution of the qualities pertaining to pure and to mixed breeds, cross-breeding in the first generation has been resorted to, known as "industrial breeding".

In the case of poultry, the results shown by such first cross-breeding are as follows: —

Egg-laying: —

(1) The hybrids obtained by crossing two breeds often prove more prolific than their parents, an increase of 10 eggs per head per year can be attained.

(2) Whatever may have been the vitality of the breeds crossed, the hybrids' eggs show better fertilisation and less waste. There is also a decrease in the death rate during rearing.

(3) Precocity is greater; young cocks reach market weight a week earlier than those of pure breeds, which results in greater economy of time, labour, and food.

(4) It is understood that owing to theirgr eaterv itality and greater fecundity, hybrid hens can be kept to advantage for longer periods; hence a further economy is effected as regards egg-laying and the care of birds reserved for reproductive purposes.

		Cross-breeding of
	Pure Breeds	First generation
Fertility of eggs	80-85 %	85-90 %
Hatching as per fertile eggs.	70-75 %	75-85 %
Death rate during rearing, up to period of egg-laying in relation to birth rate.	25-30 %	15-20 %

(6) In some cases, in special crosses, it is possible to select, with a fair degree of accuracy, the male and female birds at the time of hatching. This allows of immediate treatment according to their different requirements, fattening for the market, or egg-production.

However, the crossing of breeds of the first generation also presents serious disadvantages; this has been proved in actual practice.

(1) The tendency of hens to sit is greatly increased. In order to obtain a regular output of eggs it is important to prevent them from sitting immediately the tendency is shown.

(2) It is necessary to keep two pure-breed pens, of which one should be larger than the other : the one for the cocks should be the smaller as very stringent selection cannot be so easily followed.

(3) The only remunerative sale is that of selected fowls or sittings of eggs from the two pens of pure-bred fowls.

In practice crossing can be effected by three different methods :

(a) *Cross-breeding of two light breeds*, producing hybrid hens of maximum sexual precocity, that may hatch late in the season, when egg-laying is abundant and temperature favourable to rearing. This method is best suited to specialised production of eggs.

(b) *Cross-breeding of a light breed with a heavy breed* :— In this case, the cock is taken from the light breed, so that the hens are not injured. A special feature of this form of breeding is the particularly rapid development of the young cocks, which inherit the mother's strength ; the young hens will on the contrary, inherit from the cock's side. The young birds in this case will be heavier, and will require more feeding than in the first instance, but will possess the maximum of qualities sought for in poultry-farming

(c) *Cross-breeding of two heavy breeds* — Minimum advantages to be obtained.

After study of the practical effects of the second method of crossing, the author is of opinion that it is too complicated, entailing considerable expenditure for installation, labour, etc.

In short, in spite of the real advantages to be derived from the crossing of the first generation, it would seem that the actual money return is higher from well-tended pure breeds. P. D.

Special.

91. Improvement of Milk Production by Cow-Buffaloes

MAYMONE, B. Il miglioramento dell'altitudine alla produzione del latte nei bufali *Rivista di Zootecnia*, Year I, No 9, p. 262-276, fig 8. Portici, Italy, 1924.

The principal economic function of the buffalo is milk production The milk is very different from that of the cow and is well adapted for milk products for immediate consumption, easily digested, rich in lactic bacteria and suited to the diet of persons suffering from intestinal troubles.

From the earliest times the buffalo has been selected empirically with a view to increasing the milk yield, the average annual production being about 100 l., without including that taken by the calf. The milk has an average fat content of 7.80 %, varying from 5 % at the beginning to 12.50 % at the end of the lactation period. Consequently this milk is twice as rich and gives a yield in by-products double that of cow's milk.

An average of 22 kg. of fresh "Mozzarella" is obtained from 100 litres of buffalo milk.

The external characteristics of milk capacity are more difficult to estimate in the case of buffaloes than cows on account of the great uniformity of all the members of the same herd, this being the result of inbreeding for centuries, and also on account of the thick-set body and coarseness of the skin. Neverthless, the general form of the body, the great development of the thorax and abdomen, combined with a docile nature, a black glossy skin with violet-red tones at the perineum and mammary region, a well developed udder with a wide base, a fine mammary tissue folded when the udder is empty, less development of the muscular masss and a certain fineness of the skeleton, are characteristics of a good milk producing capacity. The striking disproportion between the fore-quarters and hind-quarters of highly-productive cows is not met with in cow-buffaloes. Moreover, preference has always hitherto been given to short-bodied rather than long-bodied animals, like the improved cattle; since 1921 the "Cattedra ambulante di Agricoltura" at Salerno has carried on a campaign against this tendency and attaches great importance to the length of the body.

Buffalo milk production is influenced by numerous factors, some depending on the individual, others on the surroundings; but the most important factor is feeding and, as the animals are reared in a wild state, they are hardy. The cow-buffalo prefers abundant green food, but does fairly well on the wild marsh flora. The natural dry prairies give the best results and the opinion is mistaken that the marsh pastures are best for grazing buffaloes Milk production depends very greatly on feed, as is well known by breeders.

Season conditions are also an important factor and severe cold has a very marked depressing effect on production.

Individual differences in production are very great The author puts the maximum production at 1548 kg. of milk and the minimum at 667 kg., for buffaloes given the same feed. RODDEMBERGER at Szasz Feneser (Hungary) puts the average annual production of 42 buffaloes at 1036.5 kg. per head, with a maximum of 1853 kg and a minimum of 482 kg. The cause of these partly hereditary individual differences is unknown, but a prominent factor is the duration of the lactation period, which is much shorter than that of the cow.

The cow-buffalo at the period of its first calving produces a smaller quantity of milk than adults, and production increases with each successive calving up to the 15th year. All other conditions being equal, milking twice a day instead of once may exercise a certain influence on individual production. TATCHEFF reports having obtained an increase of 28 % from individuals by milking 3 times a day. Breed is also an important factor in milk production, as is shown by the tests made by W. SMITH at the "Military Dairy Farm", Kirkee (Bombay Presidency, India), with 48 cow-buffaloes in the first calving period, of the *Gujerati* or *Surti*

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(1) See *R.* March, 1919, No. 341 (*Ed.*).

breed (1). The first gave an average yield of 1253 kg. of milk per head containing 8.40 % of fat, and the second 1138 kg. of milk with a 7.50 % fat content. With regard to variations in the quality of buffalo milk, the greatest differences are in the fat content, which generally varies very widely between individuals and in the same animal throughout the lactation period.

Von ROSEMBERGER, analysing the milk of 25 cow-buffaloes periodically to determine its average fat content during the whole period of lactation, found, under equal breeding and feeding conditions, individual differences of from 6.60 % to 8.10 %. In one and the same individual variations in fat content during the lactation period are still more marked, being from 5 to 9-10-12 from the beginning till the end of lactation, there being no close relation between the average and the maximum fat content

Besides individuality, age, period of lactation, milking, feeding, work, sexual intercourse and breed are factors which influence variations in buffalo-milk fat content.

The influence of the lactation period is very great Buffalo-milk fat content is at its maximum at the end of this period The product of the same milking also shows differences the milk is poor at first, but the last portions are very rich. The milk given in the evening is generally richer than that of the morning, but the factor here is chiefly the lapse of time between the two milkings

The influence of feed in buffalo-milk fat content is also very great; other conditions being equal, dry pastures exposed to the South give milk with a higher fat content than marshy or shady pastures.

As stated above, the " breed " factor also plays a great part in buffalo-milk fat content variations.

The whole of the foregoing shows clearly that the empiric selection hitherto practised by breeders has hardly given satisfactory results. Basing selection on a careful observation of production and utilising the best breeding bulls as long as possible, a genus type may eventually be found which will be the first of a new line possessing the desired characteristics in a high degree.

The choice of breeding cattle will be based on a testing at least once a fortnight of the milk production, the richness of this milk, the length of the lactation period and of the period of rest between successive lactations. Bulls out of cows thus selected, will be utilised as long as possible, in order to enable the breeder to judge of their propensity to transmit the desired qualities and ensure their permanency by close in-breeding. Pedigree bulls will be accustomed to work in order to render them docile and prevent them from becoming heavy and stiff.

To facilitate the work of selection, the author considers the economic possibility of replacing the system of breeding in a wild state by the half-wild or the stable system. From what has been done in this direction in Rumania, Egypt, Bulgaria, India and China, and from a stable breeding test in the province of Salerno with 10 cow-buffaloes in their first calving period, the author concludes that such an economic transformation in breeding is possible. In this way, and by increasing the milk-producing capacity by crossing with the Indian *Gujerath* breed, higher yields will be obtained than those in the South given by cattle specially raised for milk production. P. D.

92. Milk Production of Water Buffaloes.

LEVINE, C. O. & TO, S. T. (Canton Christian College) *The Lingnaam Agricultural Review*, Vol. 2, No 1, pp 1-8, Canton, 1924

Estimate of cost of water buffalo milk production in Canton district. The estimate was carried out at the "Canton Christian College", on 14 full grown buffaloes, the record of production dating from the time of freshening, or when the cows went dry, and continued for a period of 365 days. The authors examined successively the following:—

(1) *Feeding* consisted of concentrated foods and fodder. Concentrated foods were:— Rice bran, wheaten bran, broken rice, ground-nut cake and soy beans. The quantity of grain given the animals varied according to the state of the cow and the amount of milk produced ; an average of about 3 lb. of the grain mixture was given for each 4 lb. of milk produced; the animals were fed twice daily, morning and night, at 5 o'clock. Sufficient water was added to the concentrated food to form a thick mash

A certain amount of salt was given daily with the concentrates. Green grass cut from uncultivated land or rice straw was given the animals as fodder, four times a day and averaging 20 lb. of green fodder or 5 lb. rice straw. Cost of feeding averaged $119.32 per head per year

(2) *Man labour.* — Expense per cow, under this head, is estimated at $64.00 per head per year

(3) *Interest on capital and depreciation on cows.* — Average death rate of European cows is approximately, 27 %. At the station under observation the estimate is $1,200 (1), i. e. 8 % of cost price of a good water buffalo milking cow.

(4) The authors next examine: (a) interest, repairs and depreciation of buildings and equipment, (b) fuel, (c) milk bottling, (d) miscellaneous items.

The cows were milked twice a day, the milk being weighed immediately after milking. A buffalo cow produces on an average 5 lb. of milk per day, but its milk contains about 3 ⅓ as much fat, and twice as much total solids as the milk of European cows.

The average milk production of the 14 cows was 1985.22 lb., containing 11.25 % of fat, a production on an average of 223.27 lb. butter fat per cow per year.

The average cost of feeding was estimated at 6 cents per lb. of milk, the total cost per lb. of milk being 17.7 cents.

This figure however is subject to considerable variation from one animal to another, according to the quantity of milk produced in each case.

P. D.

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(1) $ = Canton Tael.

93. Influence of Different Oil-Cakes on the Fat-Content of Milk,

LANZILLOTTI N. (Esperienze fatte presso il R. Deposito di animali miglioratori annesso alla R. Scuola di Zootecnia e di Caseificio di Reggio-Emilia). L'azione di differenti panelli somministrati alle lattifere sulle variazioni del contenuto in grasso del latte di vacca. *L'industria lattiera e zootecnica*, Year XXII, No. 6, pp. 85-87, No. 7, pp. 100-101, No. 8, p. 116. Reggio-Emilia, 1924.

In tests carried out to ascertain the effect of different kinds of cake on the fat-content of milk, the author used 9 cows of Swiss breed, divided into three lots of as uniform units as possible, with regard to age, pregnancy, number of previous periods of lactation, time of lactation, milk production, and live weight.

Before making up these lots the cows were placed under observation for ten days, in order to obtain information as to food consumed and variations in milk production.

The experiment occupied 58 days and was carried out on two lots, one of which was fed linseed-cake and the other sesame-cake; the third, control-group received maize-cake. The basal rations were the same for all three lots of animals.

Experimental periods.

Period of	Time	Supplementary food supplied		
		1st group	2nd group	3rd group
Preparation . .	16 days	maize-cake	maize-cake	maize-cake
Transition . .	16 »	linseed-cake	sesame-cake	» »
Experiment . . .	26 »	» »	» »	» »

During the periods of preparation and of experiment a daily analysis of milk was carried out, especially as regards fat, in order to ascertain the action of the various foods.

During the 10 days of observation, the daily basal ration consisted of 60 kg. of first-cut lucerne per head; this amount was later reduced to 55 kg., supplemented by 3 kg of May hay. Later, 50 kg. of green fodder,

Chemical analysis of the three kinds of cake.

Kind of cake	Water	Digestive Matter			Cellulose	Ash
		protein	fat	nitrogen free extract		
	%	%	%	%	%	%
Linseed	11.22	32.45	8.9	31.35	9.15	6.93
Sesame .	10.10	38.30	12.73	20.95	7.12	10.80
Maize	11.05	14.15	6.25	56.00	7.50	5.05

composed of lucern and maize was substituted, after which 50 kg. of green oats were given and later 50 kg. of green clover, always however with the addition of 3 kg. of hay.

The nutritive value in calories calculated according to the formula "C" (= 1.1 protein + N. free ext. + 2.44 fat), amounts to 372.06 calories for linseed, 384.79 cal. for sesame, and 358.39 cal. for maize cake. The nutritive ratio therefore is 1 : 1.9 for linseed, 1 : 1.5 for sesame and 1 : 5.5 for maize cake.

A daily ration of cake was fed to each cow according to the live weight and daily milk production in each case

Quantity of cake given per head and per day.

Names of cows		Milk production	Live weight	Ration	
		kg.	kg.	kg.	
Lola . . .	Ist group	9.2	570	1.5	Linseed cake
Lisa . . .		11.9	510	1.5	
Flora. . .		16.2	625	2.5	
Leda. . .	IInd group	9.8	600	1.0	Sesame cake
Thecla .		10.6	580	1.5	
Mithen .		16.7	520	2.5	
Guldi .	IIIrd group	11.6	585	1.5	Maize cake
Viola . .		13.2	620	2.0	
Carmen.		12.4	660	2.0	

If the nutritive ratio of lucern is taken as 1 : 2.6, that of clover 1 : 3.7, of green maize, 1 : 10.5, of green oats, 1 : 7.5, the cows fed on linseed cake received a ration the nutritive ratio of which possessed an average of 1 : 5.7 ; those fed on sesame, a ratio of 1 : 5.6, and those fed on maize, a ratio of 1 : 6.3. The author considers the proportions sufficient for maintenance rations and for production. The daily feed was divided into two meals and the animals were in the open.

During the course of the experiment the cows were weighed every five days and thus there was an accurate record of variation in live weight while they were fed on these rations.

A cow from the first lot and another from the second lot fell sick, owing probably to certain products of the linseed and sesame cakes not being sufficiently eliminated, and to too heavy feeding ; the two animals were taken out of the lots under test, and the daily cake rations were reduced to ½ kg. per head during the third period.

Milking took place at 5 a. m. and 5 p. m. regularly and was always performed by the same man.

The above constitutes a daily decrease averaging 2.2 kg. in Lot 1, 4.8 kg. in Lot II and 0.3 kg. in Lot III; this is explained by the approaching period of lactation, as well as the approaching summer season, and should not be put against the productive value of the cake rations. The sudden variations in daily production may be explained by individual features.

Average fat content of milk per cow and per group.

Cows and Groups	Period I	Period II	Difference
	%	%	%
Cow Lola . . .	3.5	4.1	+ 0.6
» Lisa	3.3	4.0	+ 0.7
Ist Group.	3.4	4.0	+ 0.6
Cow Leda. . . .	3.6	4.3	+ 0.7
» Thecla . .	3.4	3.5	+ 0.1
IInd Group	3.5	3.9	+ 0.4
Cow Guldi . . .	3.7	3.9	+ 0.2
» Viola.	3.2	3.1	— 0.1
» Carmen.	3.2	3.3	+ 0.1
IIIrd Group. . . .	3.3	3.4	+ 0.1

Average milk-production per cow and per group.

Cows and Groups	Ist period	IIIrd period
	kg.	kg.
Cow Lola . .	8.4	7.2
» Lisa	10.0	9.0
Lot I	18.4	16.2
Cow Leda	7.9	4.0
» Thecla .	10.0	9.1
Lot II .	17.9	13.1
Cow Guldi . .	9.3	8.3
» Viola .	12.3	12.7
» Carmen .	10.7	11.0
Lot III . . .	32.3	32.0

After taking into account the principal causes that might effect variations in of milk-fat, for instance, individual tendencies and the approaching period of lactation, the following conclusions may be drawn from the experiments carried out as above :—

(1) Cattle do not appear to like linseed and sesame cakes as much as maize cake and the former might therefore cause serious ailments if given in too large quantities.

(2) The three kinds of cake had no appreciable effect on live weight.

(3) On the other hand they have a favourable influence on milk-production

(4) Linseed cake increases the fat content of milk more effectively than maize cake ; sesame cake also increases fat, but in smaller quantity than linseed cake, though more effectively than maize. P. D.

[93]

94. The Influence of Pasteurization and Diet of the Cow on the Anti-Scorbutic Potency of Milk.

OLSON, M. T. and CAPELAND, L. (Dairy Husbandry Department, South Dakota State College, Brookings, South Dakota). *Journal of Dairy Science.* Vol. VII, No. 4, pp. 370-379, Illustrations. Baltimore, 1924.

Experimental work undertaken to ascertain the antiscorbutic value of various quantities of milk produced and treated as follows: —

(*a*) Milk of cows fed a winter ration of ensiled maize.

(*b*) Milk of cows fed a winter ration without ensiled maize.

(*c*) Milk pasteurized in bottles, by heating to 52.8°C for 30 minutes compared with fresh, raw milk, from the South Dakota State College herd.

24 guinea pigs were used in experiment, the animals were quite young at the start of the experiment and weighed about 300 gm., and had been put on full diet before the experiment. Groups were formed consisting of equal numbers of males and females, uniform in all respects.

The maintenance ration consisted of crushed oats and good lucern forage, finely cut and steamed in a self-regulating apparatus for 30 minutes at a pressure of 15 lb per sq in and then dried; water and salt were added.

Basal ration only. 4 groups Basal ration plus milk from the College herd pasteurized in bottles for 30 minutes at 61-63° C, then rapidly cooled	2 guinea-pigs	30 cc of milk per day
	1 guinea-pig	45 cc. per day
	1 »	60 » »
Basal ration plus raw milk from College herd	2 guinea pigs	30 cc per day
	1 »	45 » »
Basal ration plus milk from College herd	1 »	60 » »
	2 »	15 » »
	2 »	30 » »
Basal ration plus milk from a farm herd	2 »	15 » »
	4 »	30 » »
	1 »	45 » »
	1 »	60 » »

The College herd included animals of the 4 principal milking breeds, the Holstein predominating.

The diet consisted of oats, maize, bran, oil cake (4: 4 2. 1), good quality lucerne hay (later of secondary quality).

In addition, the cows were given ensiled maize of good quality, *ad libitum*

The farm herd consisted of cross bred Jersey cows, first generation.

Their ration included maize cobs, oats and good quality of lucerne hay, for which later red clover was substituted, then lucerne hay of second quality.

Analysis of milks used in the experiments :—

	College Herd	Farm Herd
Total solid matter	12.6 %	14.2 %
Fat	3.7 %	5.3 %
Total protein.	3.3 %	4.0 %
Lactose	5.0 %	4.2 %
Ash	0.74%	0.75%

The guinea pigs, were fed twice a day and were weighed every 3 days. The animals were examined immediately after death.

In 5 graphs the authors show the results obtained and state the following conclusions :—

(1) The basal ration totally lacks " C " vitamins ;

(2) Pasteurization in closed bottles at 61°C. for 30 minutes decreases the percentage of " C " vitamins in milk.

(3) " C " vitamin in milk owes its origin to food.

(4) Ensilage of cut maize when the grain is glazed, but before desiccation of the lower leaves, considerably increases the anti-scorbutic potency of milk.

(5) A good quantity of ensiled maize contains enough " C " vitamins to allow for a sufficient quantity in the milk. P. D.

95. Production of Cow's Milk with Antirachitic Properties.

LESNE and VAGLIANO *Comptes Rendus hebdomadaires des seances de l'Académie de Science,,* Vol 179, No. 11, pp 539-541 Paris, 1924.

It is known that the milk of certain animals lacks antirachitic properties and the authors have made experiments with a view to remedy this by modification of the cow's food.

An extract of 500 gm. of cod-liver oil was added to the daily ration of a healthy dairy cow; the food was well assimilated; the general health of the cow remained excellent, appetite increased and there was no digestive trouble of any kind, the milk produced did not diminish in quantity nor show any difference in smell, colour or taste. The butter was of lighter colour, but was satisfactory in taste ; there was no difference in the quantity of butter-fat produced, which varied from 38 to 42 gm. per litre. Calcium content per litre = 1.23 gm.

Phosphoric acid (P_2O_5) = 1.40 gm. instead of the normal 0.4 to 0.6 gm.

The butter produced is rich in growth-vitamins (factor " A ") Young rats fed on husked rice, refined casein, yeast, and 3 % of butter from milk taken from a normally fed cow, increased in weight by 15 gm. in one month ; whilst those fed in the same manner, but with 3 % of butter from the milk of a dieted cow, increased in weight by 35 gm. in one month.

Butter made from the milk of a cow fed on cod-liver oil contained, moreover, anti-rachitic properties, for young rats of 30 gm. weight subjected to a rachitogenous diet but with butter from the milk of a dieted cow, only showed on inspection 25 days later very slight rachitic lesions, while the majority of them displayed no traces of disease.

On the other hand, rats thus experimented upon whose diet included butter from milk of a normally fed cow suffered from rickets to a marked degree.

Butter from milk of dieted cows possesses curative qualities in addition:— young rats of 30 gm. weight were subjected to the rachitogenous diet for a period of 15 days, after which, butter from the milk of dieted cows was substituted in their ration for ordinary butter; they mostly regained their normal health on the 40th day, a few only still showed slight rachitic lesions

The organism however does not retain the antirachitic factor: cod-liver oil absorbed by female animals during pregnancy, or during lactation, does not assure immunity for the young when later these are submitted to a rachitogenous diet

In conclusion, it can be said that milk from dieted cows whose rations include a considerable quantity of cod-liver oil, produces a quality of butter richly supplied with glycerophosphates (lecithin) and with growth-vitamins. Milk thus produced has both a curative and a preventive action on rachitis, as shown by experiments on rats. Such milk has a certain therapeutic value on infantile rachitis and its use is recommended for the feeding of children whose unhygienic surroundings predispose to rachitis.

P D

96. Hog Feeding Experiments Involving the Use of Self-Feeders.

LAGO, F P (Department of Animal Husbandry) *The Philippine Agriculturist*, Vol XIII, No 1, pp 29-44, 5 Fig, bibliography Los Baños, Laguna, 1924

The author refers to former experiments that have proved the economic value of self-feeders in hog feeding

Details are then given regarding experiments carried out with the following aims in view.—

(1) To determine the relative values of sweet potatoes, cowpeas and mangoes, together with concentrated food such as maize, rice-bran, and coconut-cake, placed in a self-feeder and at the disposal of the animal;

(2) the relative value of maize, coconut-cake and rice-bran placed in the self-feeder at the disposal of the animal, with roots in both cases;

(3) the relative advantage of self-feeders and hand feeding, using maize, rice-bran and coconut-cake in the self-feeder, at the disposal of the animals and that of the same concentrated foods fed by hand according to the modified WOLLF-LEHMANN standard;

(4) to ascertain if the addition of dried shrimps, as animal protein in the rations, is advantageous in fattening hogs, with sweet potatoes as vegetable feed.

In order to carry out these experiments the author used Berkshire-Jalajala cross-breds and three Berkshire-cross hogs. In forming the groups for experiments, the greatest possible uniformity was obtained with respect to age, weight, sex, breed, development, etc.

The animals were weighed separately for three consecutive days at the start and at the end of the experiment, as well as every 10 days during its course, between the hours of 7 and 10. The animals were constantly and amply provided with water.

The author gives details of the experiment grouped in 5 tables, from which the following conclusions are drawn :—

(1) Under the conditions of the test, for fattening hogs for the market, which received by means of self-feeders a ration of maize, rice-bran, etc., coconut-cake, potatoes and cow-peas proved to be of about the same value.

(2) As basic foods for fattening hogs for market, maize proved of greater advantage than rice-bran. In both cases the feed was supplemented by coconut-cake and sweet potatoes.

(3) The results obtained favour the use of self-feeders in place of hand-fed rations based on the modified WOLFF-LEHMANN standard.

(4) The addition of shrimps to rations, in order to provide animal protein has not proved advantageous for fattening of hogs for market.

P. D.

Poultry, Apiculture and Sericulture

97 The Effect of Cold on Germination in Eggs.

MAURO, F *La Revue Générale du Froid et des industries frigorifiques*, Year 5, Vol V, No 8, pp 274-275 Paris, 1924

M E. Mancini has already discovered that a temperature of 7-10°C. below zero, maintained for about 2 hours, is sufficient to solidify the contents of an egg without having any effect on the vitality of the germ, or its capacity for subsequent development.

The Author undertook to carry out experiments of the same kind and was assisted by Prof. Dr A. FIORENTINI and Dr. FENAROLI

The test was carried out on five lots of 10 eggs ; the first lot was placed in the refrigerator, and kept at an even temperature of 0 5°C , whilst a second lot was kept at a temperature of 14°C , ten days later, the two lots were taken out of their respective sections and placed in the incubator after an interval of 24 hrs., so as to avoid too sudden a change in temperature. Seven days later it was noted that the germ development of the eggs kept in the refrigerator was less advanced than in the second lot. The first chicken was hatched in the incubator after three weeks, from the lot of eggs that had been kept at a temperature of 14°C After 24 hours of incubation, the eggs of the first lot showed no results, whilst of ten eggs of the second lot results were positive in the case of 6 and negative in the case of 4 eggs. A 3rd and a 4th lot were allowed to remain for a period of 20 days in the refrigerator and in the ordinary section.

After 18 days of incubation, the eggs of Lot 3 gave no results whilst out of the eggs of Lot 4, 4 gave positive and 6 negative results. A fifth lot was allowed to remain 30 days in a temperature of 14°C. and showed after an incubation period of 21 days, completely negative results.

A counter-test was carried out on 45 eggs : 5 were kept for 48 hours at normal temperature and then placed in the incubator. The other 40 had, on the previous day, been placed in the refrigerator. On the day the first 5 eggs were placed in the incubator, a first lot of four eggs were taken out and these, 24 hours later, were placed in the incubator ; on the following day the same course was followed with another lot of four eggs, and so on. On the 11th day after the introduction of the last four eggs in the incubator, a general inspection was made. The germ in the five eggs that had been kept at a temperature of 14°C, for 48 hours, had developed normally ; in three of the eggs of the first lot development was normal ; in the fourth, rudimentary. In one of the four eggs of the 2nd lot, development was normal ; in another, hardly perceptible, and in the last two, nil. From the third lot onwards there was absolutely no development.

It follows from the above that, in the case of eggs kept at a normal temperature, 100 % hatching is obtained from eggs kept for 2 days ; 60 % from eggs kept 10 days ; and 40 % from eggs kept 20 days, while in the case of eggs placed in the refrigerator at a temperature of 0.5°C. the vitality and capacity of development of the germ are considerably reduced after 48 hours, and entirely destroyed after 72 hours , whilst a period of 24 hours. in the refrigerator has no appreciable effect. It is moreover proved as regards fecundation that, while it influences the conditions of eggs during the time they are kept at a relatively high temperature, if once they are placed in the refrigerator, its action is annulled after a comparatively short period.

The varying behaviour of the eggs does not depend on the actual length of time of keeping in the refrigerator, but on the condition of the eggs, their comparative freshness, and the stage of development which they have reached at the time they are exposed to low temperatures. It is therefore important to submit eggs to careful examination before placing in the refrigerator. P. D.

98. Broodiness and Egg Production.

VOITELLIER, CH *La Revue Avicole*, Year 34, No. 10, pp. 289-290. Paris, 1924

Breeders are generally agreed that broodiness among hens is not favourable to egg-laying.

A broody hen does not lay eggs ; while sitting it does not lay and after sitting, it is physiologically unable to lay eggs for a long period. The author refers to the results of several recent experiments on this question. Hens becoming broody four or six times during the year have laid more eggs than those that did not display the same degree of broodiness. In 1920 Goodale established that there could be no positive connection between the amount of time given to incubation and annual egg production.

In an experiment dealing with 152 fowls of heavy breeds (88 white Wyandottes, 16 buff Orpingtons, 16 white Orpingtons, 16 fawn-coloured

Rocks, 8 Rhode-Island Reds and 8 red Sussex), the results in relation to broodiness are summarised up as follows

	Eggs —	Average production —
Hens showing no broody propensity	26	150
» ready to sit once:	10	172
» » twice	14	187
» » 3 times	14	182
» » 4 »	19	174
» » 8 »	7	166
» » 10 »	8	164

A group of buff Orpingtons (in which a total of 37 instances of broodiness had been noted), gave an average production of 178 eggs per hen; one of these, whose recorded sittings amounted to ten, produced 176 eggs

It should be noted that in these cases the propensity to broodiness was hindered by the fact that the hens were placed in open coops and that, if checked, a hen often exhibits the desire at fairly frequent intervals Moreover the tendency to broodiness is only shown by birds that have already laid a fair quantity of eggs

According to the author the direct causes of broodiness are not yet known, the tendency is not permanent, it is displayed at constant and regular intervals in wild birds, after a certain number of eggs have been laid, but is very irregular in domestic birds owing to the modified functioning of the ovary a result of intensive feeding and other causes

Although it is difficult to modify the existing relation in a breed between laying and broodiness, and as the initial cause of broodiness is admittedly the laying of eggs, there is a risk that, in trying to do away with the first, the second might be decreased A competent breeder should be able to attain his aim, if it were proved that the persistence of broodiness is really detrimental to great production, considering that races and species of varied tendencies have been produced by natural development P D

99 Apiculture in Poland.

MALACHOUSKI, de A L Apiculteur, Year 68, No 10, pp 310-313 Paris, 1924

Although it is impossible to give even approximate figures as to the quantity of hives and the number of apiculturists, it may be said that apiculture is a natural taste among the large proprietors, farmers and peasants in Poland.

In recent times preference has been given to the *Dadant* hive, the *Lewicki* hive, however, of which the author gives a detailed description, is also used in Poland, and is well adapted to the climate and easy to manipulate Many hives, constructed of wood, without frames, and straw hives, are also found, and even the tree-trunk hive is widely used.

As regards bees, besides the native species there are many imported Italian varieties and also the Caucasian variety, but the Italian are the best producers. No one in Poland troubles about producing queens for the market, so that to have pure-breds, they must be imported.

The production of honey is fairly plentiful, this being due to the existence of acacias, lime-trees, fruit-trees, buckwheat and white clover; but few melliferous plants are grown. As regards swarming, it is mostly done naturally, except in the modern frame hives, where artificial swarming is often practised. The Gardening and Apicultural Society, which supplies a staff having the necessary technical knowledge, is at Warsaw.

Wax honeycombs, and a large part of the apicultural material, are manufactured in Poland; frame hives are left in the open air during the winter; those made of boards are kept in sheltered places or in cellars, where however rodents work havoc among them.

The principal yield of honey is in June-July, and the honey is sold in a liquid state, so as to preserve the wax of the combs, which fetches a high price. The yield is good and the honey of superior quality, except that gathered from heather, which is dark and of a disagreeable flavour.

In addition to honey, fruit wines with a honey basis and of very fine flavour are prepared; much gingerbread is also made in Poland. The peasants make a kind of mead from honey, which ferments very quickly, may be consumed after fermentation, has an agreeable flavour and contains about 1 % of alcohol. Adulterated honey is hardly ever to be found in Poland.

The people use agricultural material as little as possible, owing to the cost Honey and wax are sold at very high prices The world war has stopped progress and ruined many apiaries A Lewicki hive at present costs 120,000 Polish marks (30 frs). P. D.

100. Investigation on three Silk-Producing Lepidoptera in French Guinea.

FLEURY, P. *Bulletin du Comité d'études historiques et scientifiques de l'Afrique Occidentale française*, Vol VII, No 1, pp 39-49 Gorée (Senegal), 1924

The author has had an opportunity of observing some silk-producing insects in Guinea and gives information on three principal species.

The first species belongs to the *Liparidae* family, *Coenostaegia* genus, of which two different types are found, one in October and the other in May, which leads the author to believe that there must be two generations presenting a seasonal dimorphism, the more so, as the cocoons from which the individuals hatch out are identical. The caterpillars live gregariously and weave large silk pouches, firmly attached to the branches, within which they pass through the chrysalis state in little isolated cocoons, pressed one against the other. They feed on several trees, but especially on the " toloqui ", sometimes on the "kokoni" or "condou", on the "toumbo kori" and rarely on the " kantigui ". The author describes these caterpillars, known in Guinea by the name of " toliqui ", and the male and female butterflies, as well as their mode of life and evolution. The silk pouches are of various forms and colours; the isolated cocoons inside them are identical, whatever the form and colour of the envelope. The silk, glossy and flexible and soft to the touch, seems strong, and each cocoon contains a fair quantity. The zone inhabited by the genus *Coenestaegia* seems very extensive and the author thinks that it extends also to Casamance and Dahomey. The cocoons are easy to unwind and contain silk of a fine colour; they are connected one with another by a fine silk floss, which may also be utilised. As to the pouches, it is useless to attempt to unwind them, for they are composed of a very close tissue containing several successive envelopes They might be employed to make a rougher and coarser floss than that in the cocoons.

The second species is *Epiphora Beauhniae*, belonging to the *Saturnidae* family. The author describes the caterpillar, its stages of evolution, and the butterfly which hatches from it. The caterpillar weaves a cocoon of silvery, greyish silk. The silk produced had not yet been utilised owing to the intercrossing of the threads at the network of the opening which was a rather serious impediment to unwinding. A solution for this has since been found; but the species is especially interesting on account of the silk floss The zone inhabited and the dissemination of this silk-producing insect are very extensive; the author has met with it in the Soudan and in Guinea, where the caterpillar, which is very common, lives on the jujube-trees, it has been reported by A. SCHULTZER as living in the Cameroons, Amadua and Bornu

A third species has been met with by the author in Upper Guinea: *Chrysopsyche imparilis*, of the *Lasiocampidae* family, allied to the *Borocera madagascariensis* The caterpillar is vigorous, lives on the "Diamba-Cotton" (*Terminalia macroptera*), is common in all seasons and lives perfectly well in captivity. The author describes the caterpillar and the male and female moth

In its last stage the caterpillar weaves a cocoon of a fine golden colour, due to a liquid ejected by the animal, which changes into an impalpable golden yellow powder By a judicious selection of the couples intended for reproduction, it is thought that finer cocoons could be produced

P D.

FARM ENGINEERING.

Hydraulics, Machines and Implements

101 Hydraulics and Soil Improvement.

FORNARI, V. Le bonifiche idrauliche. Technical information and subjects for investigation, pp. 331. Rome 1924 (Published by Chierchia and Maggiorotti).

Engineer FORNARI's work brings together the information on the benefits arising from hydraulics which is scattered in various reviews and publications. In setting forth the questions dealing more especially with various systems for improvement, the author adds a description of seasonal torrent and permanent streams, which he places at the end of the article, both because swamps are often due to the action of natural water courses, and because a knowledge of this action serves as a guide, according to circumstances, for the improvements to be carried out and the constructional works necessary in connection therewith

Among other questions contained in these chapters on practical hydraulics on natural water courses and especially as regards improvements, the author gives the result of an investigation, from the hydraulic point of view only, of the possible consequences, downstream, of mountain reservoirs.

In this book will be found technical information and a development of hydraulic theories and calculations, treated in such a way as to meet the requirements of an enquiry on a work of improvement and to serve as a guide for the hydraulic work.

The original part by the Author is an analysis of the phenomenon of the coalescing of water sources and the method deriving therefrom, for making a forecast as to the maximum range to be assigned to the outflow of a basin to be drained. A. F.

102. Irrigation and its Practice.

I TENNENT, R. B and MARKS, J R *New Zealand Journal of Agriculture*, Vol. XXVIII, No. 6, pp. 357-380, figs 17 Department of Agriculture Wellington, 1924.

II. *Ibidem*, Vol. XXIX, No 2, pp. 108-118, figs 15

The authors describe the three main principles under which the natural moisture of soil may be supplemented, viz. : sub-irrigation ; standing water ; surface irrigation. The third of these methods, surface irrigation, is very fully dealt with under the following headings : Flooding from contour ditches ; flooding from field laterals ; the border-ditch system ; the border-dyke system ; the basin-check method ; wild flooding. The article concludes with a summary of initial costs, and expenses of upkeep of surface-irrigation methods.

II. — The authors continue the subject with descriptions of furrow and overhead pipe irrigation systems, and a discussion of the various implements required in the work. W. S. G.

103. Farm Implements and Machinery.

I. BUXTON, The Right Hon. N E. (Minister of Agriculture). Machinery on the Farm *The Agricultural Gazette and Modern Farming*, Vol C, No. 2645, p 289 London, 1924.

II. DUNSTAN, M. J. R. (Principal, Royal Agric. College. Cirencester) Investment of Capital in Machinery. *Ibidem*, p 291

III. Modern Machinery for Farm Work. *Ibidem*, pp. 292-295.

IV. DOWLING, R. N. Implements in the Development of Sugar-Beet Growing. *Ibidem*, p. 296.

V. **Keen, B. A.** (Asst. Director, Rothamsted Experimental Station), Soil Tilth in Relation to Mechanical Tillage. *Ibidem*, pp. 297-298.

VI. **Dockeray, R.** Why Corn Growers should own a Thresher. *Ibidem* p. 298.

VII. **McHardy, D. N.** (Author of "Modern Farm Machinery") Tractors To-day and in the Future. *Ibidem*, p. 299-300.

I. — The author points out how the use of machinery may reduce the cost of particular operations on the farm, how time may be saved, or work done which it would be difficult or impossible to perform by horse or hand labour.

Attention is drawn to the new Institute of Agricultural Engineering at Oxford which has for its main objects, the study of farm machinery, the testing of new implements and the provision of instruction in agricultural engineering.

It is not considered that the extended use of machinery will in any way reduce the employment of farm labour.

II. - The author treats the subject from the economic standpoint and shows that the farmer to-day requires a larger amount of capital than in pre-war times, and that the amount of capital sunk in implements may easily be underestimated and needs very careful consideration: It is of no use saving time by the employment of machinery if the work of the farm is not so re-organised as to make good use of the time saved.

Some of the requisites for the satisfactory investment of capital in farm machinery are mentioned : The machine must be efficient ; depreciation and wear and tear must be low ; the period of the year when the implement can be used must be sufficiently long to justify its purchase ; the implement must be in charge of a competent workman who is responsible for its condition and housing ; the farmer, his son, or a responsible employer must have a working knowledge of engineering such as will enable him to detect the necessity for, and deal with "first aid" repairs.

III. — At the request of the Editor of the "*Agricultural Gazette*" a number of farmers have given accounts of their experience of particular machines when put to the test of actual use on the farm.

A Northumberland farmer after a long experience with a 10 h. p. Rotary Tiller, considers that it is probably the nearest approach to express production on the land that has yet been attained

During the past four years a farmer in Wales, with its uncertain climate, has obtained the maximum amount of hay by employing tractor power for hauling and elevating his crop.

Another farmer describes the advantages of a tractor-drawn double-disc harrow in the making of a fine seed-bed, and in the making of a good mulch to keep the land moist in a dry season.

A Berkshire farmer considers that, on his 40 acre farm mechanical power saves at least £100 a year.

A Hertforshire agriculturist alludes to the fundamental importance of a constant and assured water supply on a farm, and how this may be obtained by the employment of a modern wind-power engine.

The use of the tractor, oil-engine and binder in all schemes of modern farming is emphasized by a Shropshire farmer, as also the employment of the sheep-shearing machine. But he draws attention to the fact that these entail more headwork for the master and that knowledge of machinery is necessary to keep them in order.

A Northamptonshire man has used the same tractor for seven years, on practically all farm operations, and has found it preferable to horses. The tractor is still in a sound condition.

A 4 unit milking machine plant has given satisfaction on a Cumberland farm, and enables from 24 to 30 cows to be milked by one man in one hour. The 4 unit machine and an 80 gallon per hour separator is driven by a 2-3 h. p. oil engine, which is also used for a turnip-cutter and to drive a dynamo for lighting the farm buildings.

The owner of two large silos, capable of holding 350 tons of silage, uses in connection with these, a tractor and cutter and blower for filling the silos. After the purchase of three tractors which proved to be unsuitable for his land, this farmer bought a general purpose light tractor in 1922, which has satisfactorily done the work formerly carried out by horses. The owner is convinced as to the utility of the modern light tractor. Other farmers also report favourably on the use of machinery, when properly managed, and one gives his experience of electric power for barn machinery , after ten year's use he states that it is the cheapest and best power for stationary machinery where the cost per unit of current is not too great.

IV. — The writer of the article on the use of implements in sugar-beet growing, R. N. DOWLING, is a recognised authority on the crop and his advice and hints should be carefully studied by all growers. Allusion is made to drills and drilling, horse-hoes and cultivators, digging implements, and also to steam and tractor power. He recognizes that reduction in the cost of growing is essential to the success of the industry and that such reduction can be effected by the intelligent use of implements, and of steam and tractor power where they can be economically employed.

V. — Valuable work has been carried out on the heavy soil of Rothamsted with the help of a dynamometer, which records the drawbar pull and speed of travel of the tractor, and when ploughing, the depth of furrow. The experience of this famous Station is that the tractor decreases the cost of work and gets it done in a given time; further, that high running expenses so often complained of, result from insufficient attention to the machinery. It was found that the resistance offered by the soil affects the speed of the tractor rather than the drawbar pull. The result follows that the power consumption *per acre* depends mainly on speed, or, the fuel consumption *per hour* is about the same whether the tractor takes 2 or 4 hours to plough an acre. Hence, time, fuel and wages are saved if the tractor is driven at as high a speed as is consistent with its construction.

As regards deep ploughing, it was found that the power consumption rose 100 % for a 6 inch depth of subsoiling in heavy clay.

Power consumption was found to be reduced as much as 15 % by chalking the land.

A reduction of friction on the mouldboard was obtained by electrical agency. If a current of electricity is passed though the moist soil from the coulter to the ploughbody, a film of water is deposited over the latter and acts as a lubricant. The laboratory results were confirmed in the field by the use of a tractor on which a dynamo was fitted.

Allusion is made by Dr. KEEN to the relative value of broken and unbroken furrows in reducing the work of subsequent operations, and the possibility of rotary tillage to produce a seed bed in a single operation.

VI. – Attention is drawn to the importance, on large farms, of the farmer owning his own threshing outfit, as in this case there is no delay in seasoning and thatching and the grower of pedigree corn can clean the machine and so ensure the purity of his seed. For economical threshing it is essential to build stacks to contain a full day's work, in order to avoid the loss of time caused by moving and re-setting the thresher.

VII. – The author of "Modern Farm Machinery" discusses the effect of the War on the design and use of tractors, and the losses caused by purchase of unsuitable machines. Mention is made of the shortage of efficient drivers, that is, men with a knowledge of both engineering and farming. He considers that the four-cylinder, four-wheeled, light-weight tractor is a general-purpose machine, which, apart from minor improvements, will remain the standard type for many years.

W. S. G.

104. Artificial Drying of Crops by Hot Air.

The Field. Vol. CXLIV, No. 3748, pp 636 London, 1924.

A process has been developed by the Institute of Agricultural Engineering at Oxford, which should enable farmers to secure undamaged hay and corn crops in spite of unfavourable weather. The crop is harvested as usual and, when possible, exposed for some hours previous to stacking. A circular stack is built round a central conical chamber, consisting of wire netting on a wooden frame. Hot air is then blown into the centre by means of a sheet metal duct from a heater in which atmospheric air has been made to circulate round red hot pipes. The hot air permeates the whole stack, the moisture is driven off as steam and after 9 hours a stack of about 25 tons is thoroughly dry.

Feeding trials will be made during the coming winter to compare the relative value of air dried and ordinary died products; it is estimated that the loss in nutritive value by the hot air method should be negligible.

The following comparative figures based on this year's trial demonstrate the economic advantages of the hot air process. When taken up on a commercial scale it is estimated that the initial outlay on apparatus should not be more than £50, exclusive of the tractor and other power unit.

Haymaking per ton of green material.

	Cutting	Carting and Stacking	Artificial drying	Haymaking	Total Cost
	£ — s — d	£ — s — d	£ — s — d	£ — s — d	£ — s — d
I. *Good Season* ·					
Artificial method .	— 3 — 0	— 7 — 0	— 1 — 6	— — —	— 11 — 6
Ordinary method . .	— 3 — 0	— 6 — 0	— — —	— 4 — 6	— 13 — 6
II. *Bad Season*					
Artificial method	— 3 — 0	— 7 — 0	— 1 — 6	— — —	— 11 — 6
Ordinary method .	— 3 — 0	— 6 — 0	— — —	— 9 — 0	— 18 — 0

M L. Y

AGRICULTURAL INDUSTRIES.

Plant Products.

105. The Cider Industry.

Le cidre. Production, Industries de transformation, Commerce. Paris, 1924, in octavo, 464 pp., with photographs May be obtained at the " Syndicat général des cidres et des fruits à cidre ", 163, Rue Saint Honoré.

In May, 1923, the National Cider Week was held at Paris. Numerous parties interested took part therein, as well as several associations and syndicates.

The present volume contains reports of this Congress, which was divided, according to the subjects treated, into four sections. In the first were examined questions relating to the fruits used in cider making and an investigation of the scientific culture of the apple-tree, of the adaptation of the different varieties and their treatment. The Congress also investigated the control of apple-tree pests in which attempts have been made to utilise certain insects (*Hyponomeuta molinella* and *Eriosoma lanigerum*).

The second section dealt with the question of the cider industry, properly so called : the manufacture, methods of control, importance of micro-organisms, cooling, various types of cider and advantages of perry.

The various subsidiary industries were treated by the third section, and included cider alcohols and brandies, the drying of fruits used in cider-making, the use of these in the manufacture of jams and jellies, the manufacture of vinegar and the utilisation of by-products.

Finally, questions relating to transport, trade and fiscal regulations were considered.

The practical conclusions arrived at by the Congress are: the improvement of orchards, the production of an alcoholic cider of standard type capable of being preserved and easy to transport, the development of subsidiary industries and the utilisation of by-products.

Those interested will find set out in this book the present position of questions relating to cider. A. F.

106. Cider in France.

" Annuaire de la cidrerie française ". Published by G. MALLET, p. 153, octavo, Paris, 1924 (Syndicat général des cidres et fruits à cidre; 163, Rue St. Honoré, Paris).

For many years the need has been felt in France of a publication containing commercial, technical and statistical information on apple production, cider and its by-products. This want made itself the more felt through the notable growth of the cider industry, as shown by the 1923 statistics, according to which 24 million quintals of apples, 19 million hectolitres of cider and 328,000 hectolitres of cider alcohol, were produced.

In the first part of this book, in which administrative questions are discussed, are given data on agricultural schools and laboratories, special instruction in pomology, legislation, fiscal regulations and conditions of transport. Some technical data are included which may be of interest, also statistical reports on production. In the commercial part the Statutes of the General Cider and Cider Fruit Syndicate and of the French Pomological Association are given, as well as a list of apple and cider producers. A. F.

107 Production of Pentosan Adhesives and Furfural from Corn Cobs and Oat Hulls.

I LA FORGE, F G (Bureau of Chemistry, Washington, D C). The Simultaneous Production of Pentosan adhesives and Furfural from Corn Cobs and Oat Hulls *Industrial and Engineering Chemistry*, Vol. 16, No. 2, pp. 130-131 Washington, D C. 1924.

II MAINS, G H. and LA FORGE, F. B (Bureau of Chemistry, Washington, D. C.). Furfural from Corn Cobs *Industrial and Engineering Chemistry*, Vol. 16, No. 4, pp. 356-359. Washington, D. C. 1924).

Production of Pentosan adhesives. - If corn cobs and oat hulls be treated with super-heated water, solutions of pentosan adhesives are obtained. In this process, contemporaneously with the pentosans, other products are formed, the principal one being furfural. In the first tests it was sought to obtain the maximum yield in adhesive substances. Subsequently, in view of the fact that furfural is of some importance as an industrial substance, the investigators also tried to discover the best conditions to ensure an increased yield in furfural. The process treats, under proper pressure, raw material with water (1 part of material to 4.3 parts by weight of water, at the surrounding temperature) and then successive concentrations (up to 28°Bé) are made of the gummy solution obtained. From corn cobs, by heating to 180°C. for 28 minutes, the yield in adhesive substances is 40-45 % and in furfural from 1 to 1.5 % of the weight of raw air-dried material. By continuing to heat from 7 to 15 minutes longer, the yield in gummy substances remained the same, but the yield in furfural rose to 2 %. If the heating be still further continued the pentosan adhesives quickly decompose with the formation of furfural.

With oat hulls the yield in adhesives is greater than with corn cobs, whereas the production of furfural is much less. By the same treatment as for corn cobs, and heating to 180°C. for 43 minutes, 61 % of adhesive substances and 0.73 % of furfural were obtained from oat hulls. If heating be continued up to 52 minutes the yield is 55 % of adhesives and 1 % of furfural.

The adhesive products obtained from these two plant offals are very small, sometimes that obtained from oat hulls is clearer and less hygroscopic than that obtained from corn cobs. One of the uses to which these adhesive substances may be put is for the substitution of sodium silicate in the manufacture of cellulose. Their widest and most promising use however is in the making of anthracite blocks, since the adhesive substances serve, as an excellent binder. The cellulose residue remaining after the process is also utilisable, either as fuel for the extraction process itself, or as raw material (replacing wood) for making cellulose pulp.

Production of Furfural. – Recently investigations and research work have been carried out with the object of obtaining cheap furfural from corn cobs. In fact during the last few years various ways of commercially utilising furfural on a large scale have been proposed. To mention only the principal, the authors draw attention to the following (1) preparation of synthetic resins; (2) direct utilisation for fungicides and insecticides; (3) resin and varnish solvent, (4) utilisation as fuel.

The usual method of preparation is to treat the corn cobs with steam under pressure. The yield is greatly increased by adding a small quantity of sulphuric acid (the quantity corresponding to the basic content of the corn cobs) which acts as a catalysing agent. By adding sulphuric acid the yield in furfural rises to 9 % of the raw material (cobs), whereas, without the acid, the highest yield was 6 %.

To ensure a good commercial yield, the operations should be carried out on a large scale, and the authors report the examination (especially from the economic side) of a project for an installation capable of treating from 40 to 50 tons of cobs every 24 hours. From 3 5 to 4 tons of furfural can thus be obtained per day. This machinery should naturally be erected in districts producing a large quantity of corn offals. Thus, for the United States, the authors indicate as most suitable, some localities in the valleys of the Mississipi, Missouri and Ohio The Authors then give detailed particulars of the estimated cost of production of furfural for an installation of the above-mentioned capacity. *The total cost of production* according to the estimate given, *would be* 6.15 *cents per pound of furfural produced.*

L. M.

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108. Furfural.

Hardy, Prof F. (Imperial College of Tropical Agriculture, Trinidad). *Tropical Agriculture*, Vol. I, No. 10, pp. 158-159, bibliography. Trinidad, 1924.

Furfural is a plant product of coming importance which can now be manufactured at a low cost from the waste materials of various crop containing pentosans, such as maize cobs, banana stalks, cotton seed bulbs, sugar cane megass, kapok waste, and saw dust. The pentosan content of maize cobs is as high as 35 % and that of sugar cane megass 25 or even 31 %.

Chemically, furfural is an aldehyde, resembling in this respect formaldehyde, and was in the first instance prepared from bran.

Furfural can be used in place of formaldehyde as a fungicide or insect repellant. It is also employed in the manufacture of gramophone records and as a solvent for varnishes, and a new anaesthetic derived from furfural is being tested. There is every prospect of a large demand for this substance in the near future. W. S. G.

109. Copra Industry and Methods of Drying in the Philippines.

Wester, P J Manufacture of Copra in the Philippines *The Philippine Agricultural Review*, Vol XVII, No 2, pp. 101-108, plates 6 Manila 1924.

Coconut growing has increased in importance in the Philippines in recent years and the number of trees planted has approximately doubled in the last ten years. It is noted, however, that a considerable economic loss has been sustained owing to the poor grade of copra produced, chiefly due to faulty drying and handling.

Experiments have been made to improve the methods of drying by the use of the sulphuring box, recommended as a cheap, effective and practicable preventative of moulds. Amongst recent inventions, the POLA copra drier has given satisfactory results and is fitted with a convenient tray shifting mechanism. The drier consists of a chamber containing several tiers of trays, placed above a boiler. The heat radiates from the boiler and passes upwards through the drying chamber (1).

The PATALON drier has also certain practical advantages as it is easily manipulated and well suited to small planters. Two arches are set parallel to each other at each end of the grill, and serve as furnaces which are fed from both ends. Five pairs of sheet iron flues are arranged to direct the smoke to two chimneys, one at each end of the brick flue. Two ventilators are so fixed as to prevent the accumulation of ash. The furnaces and intervening space are enclosed by a brick wall

The copra is laid on the grill above the furnaces and flues, spaced so as to admit a free passage of heated air from below, without allowing the copra to fall through. The entries are placed on each side of the chimneys. Uneven drying and other defects can be overcome by the use of brick flues or flues of heavy boiler sheet iron.

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(1) For a full description of the Pola drier, see *Philippine Agricultural Review*, vol. XVI No. 4. 1923. (*Ed.*)

A description is given of the preparation of copra. It is estimated that about 200 nuts can be placed on 1 square metre of drying surface, and that the driers mentioned, operated 50 weeks in the year, are capable of treating 200 hectares of coconuts, planted 100 trees per hectare, with an average yield of 60 nuts per tree per annum.

Chopping the coconut flesh fine will hasten the drying, and trays have been found more practicable than the grill. M. L. Y.

110. Cashew Nut Oil (*Anacardium occidentale*).

GEORGHI, C D. V. *The Malayan Agricultural Journal*, Vol XII. No. 5, pp. 140-141 Kuala Lumpur, 1924.

Report of the valuation tests made at the Imperial Institute, London, with both crude and refined oils. Results show that cashew nut oil resembles almond oil in most of the constants, but that there is a distinct difference in the solidifying points of the fatty acids. It is estimated that after refining with soda and partially removing the stearine, cashew nut oil could be used as an edible oil, but it is unsuitable as a substitute for almond oil in pharmaceutical preparations. M. L. Y.

111. Food Value and Economy of Ensilage.

SHEEHY, E J and DELANEY, D *Journal of Department of Lands and Agriculture*, (Ireland), Vol. XXIV, No 2, pp. 117-139, tables 5, figs 4 Dublin, 1924.

The authors' investigations were made at the Athenry Agricultural Station to ascertain the value of silage for stock feeding and the relative costs of production of equivalent food values of ensiled green food and mangels.

The conclusions reached were as follows :

The success of ensiling depends on the quality of the silage and this depends on the nature of the material ensiled, the time of cutting the crop and the method of storage. The storage chamber must be impervious to air.

Poor quality ensilage is unpalatable and acts adversely on the milk yield.

The experiments showed that 5 ½ lb. of silage is equivalent in food value to 10 lb. of mangels. The ration fed may be 21 lb. daily for calves and about 42 lb. for milch cows.

Silage is a suitable substitute for roots.

The cost of production is much less than that of mangels.

In the article other features are discussed, viz , the effect of legumes in enriching the soil, the possibility of securing a second crop from the same ground in one year, the increased corn production and carrying capacity of a farm on ensilage versus a root rotation. W. S. G.

112. United States Grades for Hays, and Methods Essential for Marketing High Grade Hay.

PARKER, E. C. (Bureau of Agricultural Economics), United States Grades for Timothy Hay, Clover Hay, Clover Mixed Hay and Grass Mixed Hay. *Dept. of Agriculture, Department Circular* 326, pp 24, figs. 2. Washington, D. C., 1924.

Until recent years, standardisation in hay grading and marketing has never become nationalised and no serious attempt has been made to study the commercial value, with reference to physical characteristics. The Bureau of Agricultural Economics has therefore organised special investigations with respect to colour and foreign material as hay grading factors and with respect to mixtures and the varying percentages of clover and other grasses commonly found in timothy hay. Further studies have been made with regard to hay trade terms and shipping and market methods.

As a result it has been found possible to grade hay approximately by uniform methods The author gives details of the recommended grade specifications for timothy and clover hay, and an explanation of the terms "class" and "grade", colour requirements, foreign material; and a full description of the haymaking, baling and loading methods essential for the marketing of high grade hay, and the distinctive features of the classes and grades of timothy, clover, clover mixed and grass mixed hays. M. L. Y.

113. Development of Fruit Preservation Technique and its Importance in Fruit Culture,

GRAM, M, Frugtopberingsteknikkens Udvikling og dens Betydning for Frugtavlen. *Tidsskrift for Planteavl,* V. 29, No. 2, pp 169-235, bibliography Konvn, 1923

The author considers the phenomenon of fruit-ripening and the methods by which it may be arrested The conditions for fruit-preserving ruling in various countries are studied and especially those relating to the transport of fruit in refrigerator cars and its utilisation in the manufacture of preserves The advantages to fruit-culture of the scientific utilisation of fruit are shown. A. F.

114. Transport of Citrus Fruits and Cold Storage Investigations.

WAKEFIELD, F. W. Overseas Transport of Citrus. *The Fruit World of Australia,* Vol. XXV, No. 9, pp. 402-403 Melbourne, 1924.

Special investigations have been made by the Author in the interests of the Central Citrus Association, Victoria (Australia), to examine closely the conditions necessary for the satisfactory transport of citrus fruits from Australia. The Author bases his observations on a critical investigation of each controlling factor influencing stored fruits: specific resistance, gov-

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erned by the position in the " Maturation Spectrum "; wounds and abrasions of the skin; conditions in a ship's hold, especially with regard to humidity and temperature and the presence of vitally active spores.

The importance of attacking the problem from the standpoint of fundamental principles is accentuated and also the direct identification of faulty consignments. M. L. Y.

115. The Storage and Curing of Batangas Mandarin Oranges.

DE LEON, J. *The Philippine Agricultural Review*, Vol. XVII, No. 2, pp. 101-108, plates, 6. Manilla, 1924.

A series of experiments on the storage and curing of the Batangas mandarin orange were conducted at the Tanauan Citrus Station (Philippines). An underground storage chamber was used, adapted to allow the entry of a slow current of air and the exclusion of warm draughts during the day time.

Results may be summarised as follows:— the ventilated type of underground storage is preferable to the unventilated chamber; clipped fruits preserve less well than those gathered in the ordinary way; the disinfection of fruit by immersion for 5 minutes in 0.018 % solution of potassium permanganate before placing in storage, markedly improves storing quality; the appearance and eating quality of the fruit is improved by six weeks storage in the ventilated chamber, and successful storage is probable even for as long as eleven weeks. M. L. Y.

116. Use of Ethylene in the Colouring of Citrus Fruit.

CHACE, E. M., and DENNY, F. E. (Laboratory of Fruit and Vegetable Chemistry, Bureau of Chemistry, Los Angeles, Cal.), *Industrial and Engineering Chemistry*, Vol. 16, No. 4, pp. 339-340. Washington, D. C., 1924.

The authors first consider generally the practice of artificial or forced colouring of oranges and lemons. This process, which may be considered "legitimate" only when applied to "healthy" or ripe fruit, has become greatly extended, especially in South California. In many species of oranges, the degree of ripeness has absolutely no relation with the colouring, *e. g.* the " California Valencia Orange ", which ripens in summer, is often better coloured in December, when it is bitter, than in the following August, when it is completely ripe. Until a short time ago the system of artificial colouring was by kerosene stoves only. The oranges were distributed in special rooms, called " colouring rooms ", in which were burning one or more open kerosene stoves, from which were given off the products of combustion.

The desired effect is due to these products of combustion. Afterwards, after having analysed the gases given off by combustion, and having repeatedly examined their properties, which are very similar to those of ethylene, this gas was directly used. The result obtained exceeded expectations. In fact, a minute percentage of ethylene in the air is sufficient rapidly to convert the greenish colour of the fruit to yellow, One part of ethylene in 1,000,000 parts of air produces in the same period the same effect as was produced by the stoves. Also one part in 5,000,000 of air produces a satisfactory effect, but in a much longer period.

In practice it has not been possible to use such low concentrations, but it has not been necessary to provide a greater concentration than 1 : 5000. It has been reported that better results are obtained by starting with an initial concentration of 1 : 20,000. The gas for this process is commercially available in cylinders. Ethylene will colour lemons with sufficient rapidity when the temperature is 60 to 70°F., and oranges at 70° to 80°F.

The use of ethylene is recommended for this process, as it is more convenient; the fire risk is reduced; the necessity for constant supervision is avoided; workmen are not exposed to the foul-smelling stoves, the fruit is never sooted from smoky stoves, and no odour is imparted to the fruit. The method can be standardised with respect to temperature, humidity and gas concentration in a manner productive of uniform results.

L. M.

117. Studies Relating to the Harvesting and Storage of Apples and Pears.

HARTMAN H., *Oregon Agricultural Experiment Station, Bulletin* 206, pp 32, tables XXIII, figs 2, bibliography Corvallis, 1924

Report of investigations made at the Corvallis Station in 1923, which include studies relative to winter varieties of pears and the handling of apples

The author gives a short account of the pressure test of maturity, based upon the lowering of the physical resistance to pressure or wounding of the epidermal and cortical layers during growth and ripening Reference is made to the full description of the "pressure tester" in the *Oregon Agricultural Experiment Station Bulletin* 186. This test is, however, materially influenced by several factors . temperature of fruit, turgidity, removal of portion of crop, russeting and colour effect.

The loss in weight after harvest, caused by humidity, aeration, temperature, time of picking, condition of epidermis and variety of fruit is fully discussed, also the general indication of maturity of the fruits and time of picking in relation to quality and time of ripening, number of pickings in relation to size and tonnage, utilization of night temperatures; red colour as an indicator of keeping quality; core rot associated with over maturity; the pressure test as applied to the apple; size and quality relative to picking time and bloom relative to loss of weight and keeping quality.

M. L. Y.

118. Loss in Weight of Stored Apples.

WATERS, R. *New Zealand Journal of Agriculture*, Vol. XXVIII, No. 4, pp. 268-269 Wellington, 1924.

Report of further investigations into the cause of apple flesh collapse and a study of the temperature humidity ratio. Experiments were made concurrently in two cool stores and the results indicate :— that in the first few weeks it is possible to measure the total drying effect of a cool store by weekly determinations of the loss in weight of a definite quantity of fruit ; that it is possible to determine the total loss in weight necessary to produce wilting ; that a 40 lb. case can lose 2 lbs. of water without any detrimental effect ; this proportion is, however, decreased with a dripping brine system ; to prevent the excess loss of weight under outside conditions compared with that in the cool stores, modifications of the temperature-humidity ratio may be necessary, in order to increase the drying power of the atmosphere in the early stages of storage ; a wet season may be responsible for difficulties in effecting a requisite loss in weight ; the relative drying effects of different cool stores with varied temperature ranges and humidity conditions might be indicated cumulatively and measured and compared periodically by determining the loss in weight of a given quantity of fruit ; to remove the requisite amount of water, constant reconcentration of the dripping brine is necessitated ; or in a dry system, much more frequent defrosting of battery pipes and longer hours of running in the early stages of storage.

M. L. Y.

119. Cold Storage for Table Grapes.

CHARMEUX, F. Utilisation du frigorifique pour la conservation des raisins de table. *Journal de la Société Nationale d'Horticulture de France*, Series 4, Part XXV, pp. 103-115. figs 5. Paris, 1924.

The author reviews the general situation as regards grape production in France, and discusses the objections raised by producers to cold storage. But, after drawing attention to the difficulties of maintaining a regular supply of acceptable table grapes on the market, the advantage of applying cold storage to certain varieties such as Chasselas are indicated. Various tests made in Holland, California and France are reported and certain practical conclusions have been drawn from the results : — (1) grapes should be quite ripe before placing in cold storage, otherwise there is a danger of detachment from the bunch, and fusion of pips skin and flesh ; (2) grapes will remain fresh in storage for at least five weeks without any deleterious effect, either on taste or quantity ; (3) methods for pre-handling should be studied ; the influence on after effects of storage have been reported.

The experiments made in France in 1923 with Chasselas grapes are described in detail. The fruit was placed part in cases, and part in flasks, and examined at various intervals during storage by refrigeration specialists. Results confirm the above conclusions and show the practicability of the cold storage of table grapes. After 65 days the fruit appeared fresh and it is probable that the time can be extended still further.

An estimation of the cost of storage has been made, viz., for 1-28 days, 70 fr. per ton. The author enlarges upon the economic value of this method and gives comparative details.

M. L. Y.

120. Some Chemical Aspects of Sweet Corn Drying.

APPLEMAN, C. O. *University of Maryland. Agricultural Experiment Station, Bulletin* 267, pp. 287-298, Tables 7, College Park. Md., 1924.

As a result of various inquiries concerning sweet corn drying, the author has assembled the results of different experiments conducted with a view to defining certain chemical changes which occur, quite apart from the question of special drying by artificial heat.

These experiments, have led to the following conclusions :

(1) Stage of ripening, the greatest bulk of dried product is obtained when the cob contains from 75-78% water and from 10-12% starch , (2) ears should be picked in the early morning and immediate preparation be made for drying ; (3) the sugar percentage extracted is low when blanched in boiling water, up to 10 minutes ; (4) during sun drying there is a considerable loss of total sugar and blanching for 5 minutes did not prevent this loss ; (5) when blanched from 3-5 minutes, the carbohydrate changes during drying at 158°, 176° and 212° F. were insignificant, the best product was obtained by drying for 3-4 hours at a temperature near to the boiling point of water, followed by drying at a very moderate temperature ; (6) drying temperatures do not appear to cause blackening or discoloration as this is evident also when sun dried , frequent stirring while dryingand removal from the drying temperature at the earliest moment is recommended as a preventive of blackening or discoloration. M. L. Y.

121. The Technology of Canning.

JONES, OSMAN. *South African Journal of Industries,* Vol. VII, No. 8, pp. 507-512 Pretoria, 1924.

A discussion as to the best methods of canning meat and raw food materials, with an account of the research being carried out by the National Canners Association, U. S. A., in connection with the thickness of the tin coating ; the quality of the tin plate ; the types of can ; the sealing fluid ; the production of tinned meats ; sterilisation improvements ; causes of discoloration ; metallic contamination. M. L. Y.

Animal Products.

122. Variation of Cream Tests.

CHALLIS, E. C., *Africa. Journal of the Department of Agriculture,* Union of South Africa Vol. IX, No. 4, pp. 334-340. figs. 8. Pretoria, 1914.

The causes of variations met with in cream tests are discussed, and attention drawn to what is probably the chief cause of such variation, viz., the running of the cream separator at different speeds.

A separator was run at the correct speed of 60 revolutions of the handle of the macchine per minute and cream containing 34 % butter-fat was produced ; the speed was then increased to 74 r. p. m. when the fat percentage rose to 52 %. In another case by reducing, the speed of the machine 25 % the fat content of the cream fell from 54 to 26 %.

W. S. G.

123. Solubility of Milk Powder.

I. Fouassier, M. (Institut Pasteur). L'insolubilisation progressive des poudres de lait. *Le Lait*, Year IV, Vol. 4, No. 35, pp. 366-369. Lyons, 1924.

II Suppler, G C. and Bellis, B (of the Research Laboratory of the Dry Milk Co at Adams, N Y) On the Solubility of Milk Powder. *Le Lait*, Year IV, Vol 4, No 35, pp. 358-366 Lyons, 1924.

I. Progressive insolubility as shown in certain milk powders shortly after their manufacture implies a serious change of condition in the powder, which obviously reflects on its use and value.

The author in the course of his experimental work has observed particularly rapid insolubility in powders produced by the process of desiccation in which milk is poured so as to cover heated cylinders; while insolubility was reached very slowly and was almost imperceptible in powders produced by a process of spraying in heated chambers and preserved in tin boxes.

Under the microscope milk powder produced by the cylinder process, or Powder " A ", appears as amorphous masses varying in size, and with irregular outlines, it is coarse, and of rough texture, whereas milk powder produced by the spraying method appears as small rounded grains, very fine in texture and passing easily through the fingers

In the cylinder process, the desiccation temperature reaches a maximum of 100°C which affects the albumen but has little or no effect on the casein.

As regards acid content in milk, the author's observations show that milk powder produced from fresh milk of normal acidity gradually loses its solubility.

Various tests carried out by the author on Powder " B ", gave the following results The insolubility coefficient reaches a maximum but 5 % moisture is sufficient to start insolubility in the powder.

This progressive insolubility of milk powders is but a natural consequence of the precipitation of lactic acids on casein, a process which is greatly stimulated by moisture and heat

The degree of moisture absorbed, or insufficiently eliminated during manufacture, is favourable to and may actually bring about the insolubilizing action of lactic acid on the casein in the powder.

It is therefore of the highest practical importance to reduce the moisture content, at the time of manufacture, to approximately 3 %, and to maintain this percentage by suitable packing so as to secure protection against moisture in all forms through contact with the air.

II. Solubility in quite fresh milk powder varies according to the process of manufacture, according to the acids contained in the liquid milk used in manufacture, and according to certain conditions depending on the methods employed in the desiccation process. Another factor appears after a certain time of storage, viz., that of the moisture content, either the moisture already contained in the powder, or that absorbed from the atmosphere.

The authors have carried out a series of special tests which have led to the following conclusions: —

There is a direct relation between the moisture content and the development of insolubility in the proteins of milk powder during storage. There is a complete absence of casein after treatment in the centrifuge under certain conditions, at the end of 7-8 weeks, during which 100 litres of moist air had been passed through the milk powder daily.

The moisture content of the powder increased from less than 2 % to approximately 11 %.

An identical capacity for moisture absorption and consequently, a similar development of insolubility of the casein is found in the milk powders obtained by the cylinder process as in those obtained by spraying

Air freed from moisture passing through milk powder under the same conditions as moist air, effects no change in the solubility of the proteins during a period of six months It appears that the proteins will maintain their original solubility as long as the powder is kept absolutely free from moisture The original solubility of casein in milk powder can be maintained for one year and longer provided the absorption of moisture is less than 3 % Samples with an average moisture content of 3 to 5 % and whose solubility showed but slight alteration in the course of a year, became almost entirely insoluble in the space of a few days when their moisture content suddenly rose to 6 5-7 %.

The product obtained after centrifugal treatment of milk powder (cylinder process) contains approximately 3 % protein and 7 % ash, consisting of calcium oxide, magnesium and phosphoric acid Analyses show that insoluble calcium phosphate and undoubtedly also insoluble magnesium phosphate, are the chief ingredients in the mineral precipitate.

P. D.

PLANT DISEASES

Plant Parasites.

124. Plant Diseases and Pests observed in Denmark.

GRAM, E. and ROSTRUP, S., Oversigt over Sygdomme hos Landbrugets og Havebrugets Kulturplanter i 1922. *Tidsskrift for Planteavl*, Vol. 29, Part 2, pp. 236-309, figs. 2 Copenhagen 1923. (Received 1924).

The period of observation. (1 Oct. 1921 to 30 Sept., 1922) was characterised by a dry, sunny autumn, and frequent heavy storms and cold, dry weather in January and February, a late spring and very cold, wet summer.

Numerous slight and many serious cases of attack on barley by *Pleospora graminea* were observed; attacks by *Tilletia Caries*, on the other hand, were fewer, in consequence of the seed having been disinfected. Conditions favouring infection increased the attacks of *Ustilago Hordei, U. Avenae, Urocystis occulta. Heterodera schachtii* var. *avenae* caused much damage to oats. In Jutland, *Oscinis frit* larvae and in a lesser degree those of *Chlorops taeniopus* were unusually destructive. *Hylemyia coarctata* larvae renewed their attack on wheat after many years, and those of *Agriotes lineatus* proved more than usually destructive.

Vegetables, during the rainy summer, were seriously attacked by *Sclerotinia sclerotiorum, Ascochyta Pisi, Fusarium* spp. and *Botrytis; Macrosporium Pisi* was also abundant and in some places completely destroyed the crop. Very abundant *Biston zonarius* larvae appeared in a field of trefoil in July, which they almost completely devoured.

Repeated experiments proved that beet " mosaic ", which appeared early and was very destructive, is not transmitted by the seed. *Hypochnus Solani* was very abundant on many crops, including the beet.

Phyllotreta nemorum and other Coleoptera of the *Halticidae* family, in many places necessitated a second sowing; tests by spraying with nicotine sulphate (0.1 %) and with lead arseniate (0.2 %) gave good results. *Ceutorrhynchus quadridens* larvae were rather destructive to mangels; the mangel seed crop and the product of other largely cultivated edible Cruciferae were to a great extent destroyed by *Meligethes aeneus. Chortophila brassicae* larvae, which were extremely destructive, were effectively combatted in the tests carried out with tarred paper discs and with two sprayings of 0.1 % solution of corrosive sublimate

In Jutland, leaf curl of carrots caused by *Trioza viridula* was somewhat extensive.

Potato " mosaic ", leaf roll and other virus diseases, showed great increase, apparently due to the warm, dry summer of 1921.

In some localities *Apamea testacea* larvae partially damaged *Festuca elatior* seed crops, as well as some fields of barley The migration to the roots of Graminaceae by *Aphis fitchii* Sanderson was proved by tests.

Fusarium Willkommii, the conidial state of *Nectria galligena*, caused rot in apples and pears during storage; *Gloeosporium album* was also reported on the former. Attacks on fruit-trees by *Xylotherus dispar* were reported for the first time. *Hoplocampa testudinea* and *H. fulvicornis* larvae on apples, pears and plums were unusually numerous. The apple shoots in some places were attacked by *Blastodacna putripenella* larvae. Abundant *Carpocapsa pomonella, Olethreutes ocellana, Cheimatobia boreata* and *Ch. brumata* were also found on apples; the last-named was also found on the black currant.

Leaf spot caused by *Marssonina Potentillae* var. *Fragariae* were reported for the first time on strawberries. Strawberry fruits were damaged by *Mermis* sp., *Anthonomus rubi* did much damage to strawberries and in some places also to raspberries. Near Copenhagen *Acalla comariana* larvae were very destructive to strawberry crops.

In various places *Nematus ribesii* stripped the leaves from currant-bushes; spraying with tobacco extract 0.2 % immediately killed recently hatched larvae.

During the wet weather beans were greatly damaged by *Glomerella Lindemuthiana*, *Sclerotinia sclerotiorum* and other fungi.

Phytophthora infestans on tomato fruits was effectively combatted with 2 % Bordeaux mixture *Verticillium albo-atrum* appeared in some places. *Cladosporium fulvum* was very destructive but was controlled by abundant ventilation and heating of the hot-houses during the night; better results were obtained with lime-sulphur mixture (1 : 40) than with 2 %. Bordeaux mixture.

Leaf spots due to *Phyllosticta Cucurbitacearum* were observed on melons.

Heterosporium Allii appeared on leeks.

Graphiola Phoenicis and *Exosporium Preslii* were found on *Phoenix* leaves. *Volutella ciliata* was noted on the dead parts of *Aspidistra*. *Dianthus* plants were damaged by thrips and by *Hylemyia cardui* larvae.

Very extensive damage due to frost was caused to certain varieties of wheat, especially if sown late, also to certain seed crops, roots and stored potatoes fruit-trees and shrubs and many ornamental plants.

The heavy autumn storms in 1921 caused much damage through the action of salt water

Among the various insecticides tested, "Venetan" a nicotine soap, a mixture of soap and methylated spirits, "Belumnite", the "Apa-Fumus" bandages and nicotine sulphate proved more or less efficacious against various aphides.

Damage by spraying was caused to apples and roses by an application of 2 % Bordeaux mixture followed by 0.05 % aceto-arsenite of copper and on pears by 0.5 % formalin. A tobacco extract containing free ammonia caused all the leaves to fall. A F.

125. The Growth Reactions of certain Fungi with reference to their Excretory Products.

BOYLE, C *Annals of Botany*, Vol. XXXVIII, No CXLIX, pp. 113-135, graphs 5. London, 1924.

The author has investigated the staling of liquid media, and has attempted to discover, how, and to what extent, the capacity for growth could be recovered.

A species of *Fusarium* possessing very active staling properties was used to produce the staling products Cultures were made on Richard's solution, with normal and reduced phosphate, potato extract, and apple extract. The progress of staling was measured by the inhibitive effect of the stale liquid on the germination and growth of spores of *Botrytis cinerea*, since the spores of this fungus were much more susceptible to the metabolic products of *Fusarium* sp. than were the spores of *Fusarium* itself. The amount of growth of *Fusarium* sp. was determined by weighing the mycelial mat, and the hydrogen-ion concentration was ascertained by the colorimetric method.

Inhibition of growth in staled media was not due to lack of nutrient materials. The effect of boiling the staled medium was to restore its capacity for growth in the early stages, but the effect decreased as the medium became more stale. In all four media the fungus caused a decrease in hydrogen-ion concentration as the medium became increasingly stale. In the early stages of staling, readjustment of the pH value of the medium restored its capacity for growth. At a later stage however. correction of the pH value had no apparent effect, doubtless on account of the presence of other inhibiting factors. Boiling and correction of the pH value had an added effect in promoting growth in a staled medium, when, separately they were ineffective.

Cultures of *Fusarium* sp. and *Botrytis cinerea*, on Richard's solution, apple extract, potato extract, and mannite of various reactions, showed that the pH limits and optimum for growth of the two fungi are not absolute, but depend on the medium on which they are grown. Since the medium is continually changing during staling, the pH limits of growth may alter in consequence, but within wide limits, the change in reaction is not, in all probability, a limiting factor for growth. C. B.

126. ***Cephalosporium Acremonium*, a Hyphomycete Harmful to Maize in the United States of America.**

REDDY, C. S. and HOLBERT, J. The black bundle disease of corn R. *Journal of Agricultural Research*, Vol XXVII, No 4, pp. 177-206, figs. 4, tabl 6. Washington, D. C., 1924.

The disease, described by the authors under the name of "black bundle disease of corn", has been observed on *Zea Mays indentata, Z Mays indurata* and *Z. Mays saccharata*. The most characteristic symptom of this disease is the presence of black vascular bundles in the stems and sometimes in the leaves of maize The following anomalies are found in a pronounced degree in connection with the disease : excessive production of offshoots, prolificity of the stem, which shows a tendancy to develop ears corresponding to numerous nodes, or to produce several ears united in a single bunch ; the red or purple colour of the leaves and stems ; stems with aborted ears ; stems bearing imperfectly developed ears only.

The disease, which probably exists in every part of the United States where maize is cultivated, has up to the present been reported in the following States : Connecticut, New York, Ohio, Indiana, Illinois, Wisconsin, Minnsota, Iowa, South Carolina and California. The damage caused by it is considerable.

The Mucedinacea *Cephalosporium Acremonium* Corda has been found in close relation with the group of symptoms above mentioned ; it has been isolated and cultivated on various media. The fungus has produced many of the said symptoms after being inoculated in pure cultures.

The disease caused by this fungus is transmitted by the seed. *Ceph. Acrimonium* penetrates into the grain through the vascular system and lives there until conditions become favourable for germination. It does not generally impede germination, nor restrict early growth ; the fungus specifically attacks the development of the grain and towards the end of the growth period causes a general withering.

In reducing loss caused by this disease, the plants showing any of the symptoms in question should, above all, not be deprived of ears of which the seed is to be utilised for sowing. Probably the best means of combatting the disease will be the development of resistent varieties of maize. Preliminary tests, not yet completed, as to the treatment of seed for sowing, promise good results. A. F.

127. *Phytophthora omnivora*, a Phycomycete injurious to the Pepper Plant in the Campania.

TROTTER, A. « Cancrena pedale » del Peperone e Melanzana nella Campania (*Capsicum annuum* a *Solanum Melongena*). *Rivista di Patologia vegetale*, Year XIV. Nos. 7-8, pp. 125-130. Pavia, 1924.

For some years, here and there in the Campania, and especially in the Province of Naples, mlongena plants, and still more often pepper plants, already in the nursery or soon after transplanting, or also towards the flowering period, show signs of wilting especially in the afternoon, and then recover somewhat during the night, this continuing until they become completely yellow and dried up. Only a few of them, though drooping, survive flowering and fructification.

The stem, especially near the collar, appears considerably contracted and emaciated, the tissues down to a certain depth being browned, especially when the disease has reached its culminating stage. From the collar it tends to spread in an upward direction, and sometimes may even reach the juncture of the branches and advance along them. The roots appear to be normal.

The disease, to which the author proposes to give the name of " cancrena pedale ", is, in his opinion, exclusively due to *Phytophthora omnivora*, though associated with this Peronosporacea a fungus (*Fusarium* sp.) and a Nematode have been found.

Preventive means: 1) collect and burn the diseased plants; 2) renew the seeding plots, change their position where necessary or disinfect them, and apply, possibly, a mineral fertiliser, 3) disinfect the seed with a 1 % solution of copper sulphate and afterwards wash in lime water; 4) spray the seedlings, as soon as transplanted, with ordinary Bordeaux solution, and the seedlings in the nursery, in the last period, with a 5 % copper-lime solution; 5) if the infection is intense and widespread, temporarily replace the pepper plant and melongena crops by other plants known to be immune. G. T.

128. " Vine Mildew " (*Plasmopara viticola*) Reported for the First Time on *Ampelopsis Veitchii* in Europe.

LÜSTNER, G. Über das Auftreten der *Plasmopara viticola* Berlese et de Toni auf *Ampelopsis Veitchii* in Rheingau. *Nachrichtenblatt für den deutschen Pflanzenschutzdienst*, Year 4, No. 10, pp. 75-75. Berlin, 1924.

In the year 1924 — when there was a severe attack of *Plasmopara viticola* on the vines in Rheingau (Germany), combined with unusual dampness — "mildew" was reported for the first time in that region on *Ampelopsis Veitchii.* The fungus appeared at the beginning of September, only on the young leaves of the branch apices (the older leaves, on the contrary, remained immune) and caused spots, all of irregular shape, to appear on them, which spots, at first brownish-green in colour and transparent, afterwards browned or reddened and dried. The white efflorescence which formed on the underside of the spots, was not so evident as in the case of the vine-leaves, but scarcer and more delicate; it became more accentuated after remaining in a damp room. A microscopic examination of the conidiophores forming the white efflorescence and of the fungus spores, showed that these organs corresponded, in shape and size, with those of *Pl. viticola.*

The presence of the fungus on *Amp. Veitchii* has already been known for some time in North America. Its appearance on the same plant in Europe may meanwhile, in the opinion of the author, furnish additional proof of the fact that the parasite is adapting itself more and more to the local conditions here.

G. T.

Animal Enemies.

129. ***Tomocera californica*** Hymenopteron parasitic on the ***Coccidae Ceroplastes rusci*** and ***C. sinensis***, reported as new to Europe.

GARCIA MERCET, R. Pteromálidos de España (*Hym. Chalc.*). Primera nota. *Boletin de la Real Sociedad Española de Historia Natural*, Vol. XXIV, No. 9, pp. 421-439, figs. 4. Madrid, 1924.

This note contains more especially morphological descriptions of the genus *Tomocera* Howard and of its species the *T. californica* Howard type. This Calcidide Hymenopteron, not previously reported in Europe, has been found in Spain, in the Parque de Montjuich, near Barcelona, on *Ficus Carica* and *Myrtus communis*, as a parasite of the (*Ceroplastes rusci* and on *C. sinensis*. The Author has obtained 30 specimens of the species in question, all female, from fig and myrtle branches, respectively attacked by *C. rusci* and *C. sinensis*. The first of these coccidae was attacked by many *T. californica* and also *Scutellista cyanea* parasites. On the *C. sinensis*, on the other hand, only one specimen of *Tomocera* was found. It should be noted that the myrtle and fig trees attacked by *Ceroplastes* grew near one another.

The characters of two other Calcidide Hymenoptera living in Spain are also given:

1) *Caratomus megacephalus* (F.) found at San Raphael (Prov. of Segovia), the biology of which is still unknown; 2) *Amblymerus maculipennis* Mercet found on *Olea europaea* at Vaciamadrid (Prov. of Madrid); the biology of the latter is also unknown at present.

G. T.

130. *Leucopis (Neoleucopis) luteicornis* n. sp. a Parasitic Dipteron of the Coccid *Phenacoccus iceryoides*, in Coimbatore (India).

MALLOCH, J R A new ephidiphagous fly from Coimbatore. *Memoirs of the Department of Agriculture of India, Entomological Series* Vol., VIII, No. 7, pp. 67-68. Calcutta, 1924.

Leucopis (*Neoleucopis*) *luteicornis* found in Coimbatore as a parasite of the Coccid *Phenacoccus iceryoides* Green ("rain-tree mealy bug"), is described as a species new to science. G. T.

131. Study of the Methods used for Control of the Olive-fly (*Dacus oleae*) in Portugal.

Report of Mr. A F. DE SEABRA, Head of the Section for special studies in the Laboratory of Plant Pathology "Verissimo d'Almeida", at Coimbra, transmitted by Mr. E LEÃO, Delegate of Portugal at the International Institute of Agriculture

Introduction. The Portuguese Mission for the study of biological and chemical methods for the control of the "olive-fly" (*Dacus oleae*), has not at present got beyond a general organisation of the work to be done in the country

In Portugal the olive tree is not an object of great care: periodical pruning often neglected, rarely tilled, hardly any manure applied. This hardy tree, thoroughly well adapted to our climate, has endured all the inclemencies of its surroundings without ceasing to develop and to fruit.

Care of the olive, and an endeavour to carry out control of its parasites, and to diminish the consequences of disease, were aims which our agriculturists had never set themselves

A few years ago the olive in certain parts of the country was attacked by very grave epiphytic disease. A disease of the roots, very similar in its results to that of chestnut, walnut and other trees, has recently caused the death of hundreds of fine trees. Unhappily, from other regions, serious infection is reported, caused by the *Bacillus Savastanoi* (Bacterial tumour of the olive) which has naturally caused anxiety to growers.

The studies on the "olive-fly" carried out by the methods which we have selected in the endeavour to obtain abundant material from all parts of the country, showed not only the importance of these epiphytic diseases, but also their wide extent.

If these studies can be continued for 3 or 4 more years, without diminution of the impetus which the Public Authorities have given, it should be possible to draw definite conclusions as to the importance and the efficacy of the methods employed against *D. oleae*, and also to obtain a thorough knowledge of all diseases and enemies of the olive-tree in Portugal.

The results of these studies, of such economic and scientific interest, will be in proportion to the amount of support which they continue to receive from the Public Authorities, and from those principally interested, the growers.

The present organisation for studying the means of control of D. oleae in Portugal. — After the International Conference held in Madrid in 1923 with a view to the conrol of the " olive-fly ", at which the author had the honour to represent the Portuguese Government, and was charged by the Director General of Instruction in Agriculture, Prof. AZEVEDO GOMES, and by the Director of laboratory of Vegetable Pathology, Prof. SOUZA DA CAMARA, to draw up a plan of work for studying the methods recommended abroad for the destruction of *Dacus* and for the study of the biology of the insect, of its parasites and natural enemies.

The author has endeavoured first of all, to be as completely informed as possible, on the present state of the question in the different countries, where they have already worked for some years on the solution of this problem, especially Italy, Spain, France and Serbia. The importance attributed to the two chief methods of control, the chemical and the biological, make it essential to collect all possible information in the country on this subject; no other means being available, as none of the methods recommended abroad for the control of the " fly " have as yet been seriously tried, a scheme of work has been drawn up, which was presented at the beginning of last year to the Director General of Agricultural Instruction, and published in our report on the Conference at Madrid (1) (Part of the report is given below).

Organization of experiments and special investigation work. — In considering the present state of our knowledge on the biological study of the *D. oleae*, of its parasites and the means advised for the control of this species, which is so destructive to our olive groves, it is evident that a special service must be organised for investigation and experimental study, which will be able to draw definite conclusions as to the efficiency of the methods to be recommended to growers as being the most practical and economical to adopt in defence of their plantations.

The Laboratory of Plant Pathology, and especially the Section for Special Studies at that Institute, should be charged with the direction of these services.

In the different parts of the country, where olive growing is most intensive, or in other parts, where biological observation of the " fly " or its parasites, may have special interest, experimental stations should be established to test the treatment and for the direct observation of *D. oleae*.

In other parts, where the olive is not of so much importance, observation stations will be installed, exclusively for gathering information

The Special Studies Section of the Laboratory will become the Central Station and will be linked to all the experimental and information stations.

The different stations should, where necessary, keep up a direct correspondence with the growers in the different areas.

Special Organisation of Services. — The Central Station (Section of Special Laboratory Studies) independently of direct observations and experiments on treatment, which it should carry out under the same conditions as those applying to the experimental stations, should also direct the organization of all scientific and experimental investigations as regards these studies, furnish all the necessary instructions to these stations and put at their disposal the necessary means for work.

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(1) International Conference held at Madrid for the control of *Dacus oleae*, or the olive fly (mosca da azeitona). Report presented to the General Director of Agricultural Instruction, Dr. Mario De Azevedo Gomes, by A. F de Seabra, Portuguese Delegate to the Conference (Coimbra, 1924, p. 58, map 1).

In these experimental stations, as well as at the Central Station, the work carried out in the plantations should be accompanied by meteorological observations, made in the locality.

The Central Station should receive periodical information from the different stations and material for study, specimens of blighted fruit, etc., in order that an exact knowledge of the invasion may be obtained Specimens of *D. oleae* and its parasites must also be procured from different parts of the country.

The experimental stations, besides carrying out the work confided to them by the Central Office and all the investigations on the biology of *Dacus* and its parasites, asked for by the Office, could also make other experiments and carry out other studies, with special regard to the application of the methods advisable in each district.

To facilitate correspondence and the forwarding of specimens, it will be necessary to obtain free postage, on the grounds of public utility, and as belonging to a national service

The information stations should take entire charge of the correspondence with the Central Station and when necessary, with the olive-growers of the district or department in which they are established.

The staff of the Central Station will be composed of the Head of the Section for Special Laboratory Studies, a forest expert, an agricultural expert, and a demonstrator

In the experimental stations a forest expert and an agricultural expert should be added to the staff engaged in field work.

The directors of experimental stations should send a detailed report each year to the Central Office, to be printed and used by the Central Station for drawing up an annual report. According to the decision of the International Conference at Madrid, these reports will be communicated to the International Institute of Agriculture at Rome, during the first half of October each year. The Institute must communicate the results obtained to the countries concerned in the shortest possible time The Conference of Madrid has expressed a wish that a permanent International Commission of Experts should be formed, with a view to the study of the various matters concerning the " olive fly ". This Commission must meet at least once a year. The first assembly will take place at the International Institute of Agriculture in Rome. At each Assembly it will be decided where the next will be held

The study of the biology of the *D. oleae* and of its parasites, as well as methods to be tried, as being the most practical and economical way of control ought to be repeated for two or three years in all parts of the country.

Conclusions on the subject of the special service organization. — Having thus explained the importance to the country of the organisation of special services for the destruction of the " olive fly " by the use of artificial methods, as well as by biological or natural methods, it is suggested that the service be considered of public utility and therefore come under the benefits of the law, by which means it can have practical and immediate realization.

The chief direction of the services ought to be assigned to the Laboratory of Plant Pathology, as it is the official institute of the Ministry of Agriculture and is organised especially for this work.

Considering also, that very particular attention must be given to these studies for which it will be necessary to have a specialized investigation staff, the direction ought to be entrusted to the Section of Special Studies of that Laboratory which is at present established at Coïmbre, one of the most centrally-situated parts of the country and very important from the point of view of olive culture.

Considering the importance of investigations carried out in different climates and altitudes, the experimental stations will be established in the districts of Braganza, Coïmbre, Leiria, Castelo-Branco, Santarem, Lisbon, Béja, and Faro.

The experimental station of the district of Braganza should be established at Mirandola where olive culture presents a special interest

The experimental station of Castelo-Branco should be established in a district particularly rich in olive groves. This station, as well as that of Mirandola, ought to possess an experimental field for trial treatments, and investigations on the biology of the *D. oleae* and of its parasites.

The experimental station of Leiria should be established under the same conditions. At Santarem, because of the exceptional importance of the olive plantations in this district, in addition to the experimental station, which could be established at the Agricultural School of the district, having also an experimental field, there ought to be other experimental fields in different areas for the study of methods of treatment and of the biology of the " fly " and its parasites

The station of Béja should be established also in a district rich in olive-trees, such as Moura, for instance.

Owing to the special conditions of the area and particularly of the climate of the province of Algarve, the experimental station of Faro presents a special interest from the point of view of the biological study of the insect and its parasites. The investigations of this station might preferably be made in the neighbourhood of St Bras de Alportel, far from the coast, and close to Tavira, near the sea.

Information stations should be established in agricultural districts and sub-districts where they do not now exist. These information stations will be a very great advantage in the study of the distribution of the " fly " and of the parasites that might be discovered in the future in the country.

The technical staff entrusted with the direction of the Central Station and of the experimental stations must deal only with their own special studies.

A special fund must be allowed for the travelling expenses of the technical staff, for salaries of the staff, for purchasing material for experiments and material for study.

The plan given above has been officially adopted. The stations of Coïmbre, Santarem, Borba (instead of Moura as at first suggested) and Silves (instead of Faro) have begun work under the direction of the scientific agricultural experts, LUIZ MAGALHÃES, EDUARDO DE ALMEIDA, CAMARA MANUEL and ALMEIDA DE BIVAR.

Experimental fields, independent of these stations, have also been established in the olive groves of the Higher Institute of Agriculture and at the Central Agricultural Station in Lisbon.

Preliminary work. — Although very widespread in all parts of the country where the olive tree is cultivated, the species *D. oleae*, is still confused by growers, because of the nature of the harm done, with other parasites of the olives, particularly with *Prays oleaellus* with regard to insects, and with *Gloeosporium olivarum* among cryptogams.

On the adoption of the scheme of investigation, a circular was sent to the most important growers of the country, containing the necessary instructions for obtaining the greatest possible number of samples of parasitized olives, from all parts of the country, as well as detailed information on the importance of the invasion.

The samples of parasitized olives were specially intended for studying the chorographic spread of the fly and for the verification of the existence of its parasites.

Nearly six hundred circulars were sent by the Special Laboratory Study Section. At the same time the General Director of Agriculture instructed his agricultural statistics assistants to correspond with the Laboratory, and tried to obtain also as great a number of parasitized olives as possible.

Meanwhile the staffs of the stations organised for studying experimental methods for the control of *Dacus*, tried to obtain and forward to the Central Station a large number of specimens from their districts.

In a few months it has been possible to organise a system of official and private correspondence, which has kept us well informed of the advance of the invasion.

The meteorological conditions severely handicapped chemical experiments. However, several hundreds of trees were treated in the experimental fields of the different organised stations.

The Lotrionte process seems without doubt the only one which can be adopted profitably in the country, because of the irregularity of the seasons.

The experiments to control the fly by artificial means, being thus handicapped, especial attention was given to to the study of biological methods and in trying to obtain a large number of parasites of the " fly ", and limiting ourselves for the moment to ascertain the species, and to know their chorographical spread and their numerical importance.

Very concise instructions have been distributed to all the growers and to the staff of the General Direction of Agriculture who were asked to collaborate in this study, also a number of little wooden boxes were sent,

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of the type used by the laboratoty at Washington for the study of "brown tail moth" (*Euproctis chrysorrhoea*).

In a few weeks several samples of the parasitized olives had been collected in the Laboratory, by which means the existence of "Dacus" and other olive parasites, especially *Pr. oleaellus*, have been verified.

The elaboration of an annual report on these studies is very difficult at this time of the year, which is just the time of the greatest activity of the investigation and experimental work.

The period when the "fly" and the affected plant are at rest seems to be the only time available for this work. The months of February, March or even April, would be the most favourable for us at least, to collect the results of the work and to elaborate a general report on the results.

First trials of treatment. — The first trials of treatment were carried out in the experimental fields of Coimbre, Santarem and Borba.

The insecticides used in these experiments were prepared at the Central Station and forwarded in concentrated solution to the stations.

The following formulae were tried:

Molasses	65 parts
Honey	31 "
Glycerine	2 "
Arsenate of soda	2 "
Water	10 "

Liquid glucose	7 kg.
Copper sulphate	700 gm.
Citric acid	40 "
Water	10 "

Molasses	7 kg.
Copper sulphate	700 gm.
Citric acid	40 "
Water	10 l.

Molasses	7 kg
Copper sulphate	700 gm.
Citric acid	40 "
Arsenate of soda	400 "
Water	20 l.

(dilute with three parts water).

Molasses	10 kg.
Arsenate of soda	300 gm.
Water	90 l

Molasses	10 kg.
Arsenate of soda	200 gm.
Water	90 l.

Molasses	15 kg.
Arsenate of soda	300 gm.
Water	100 l.

Molasses	19 kg.
Arsenate of soda	200 gm.
Water	100 l.

Molasses	5 kg.
Arsenate of soda	200 gm.
Boracic acid	200 "
Borate of soda	200 "
Water to	10 l.

Molasses	5 kg.
Arsenate of soda	200 gm.
Boracic acid	200 "
Borate of soda	200 "
Water to	10 l.

Liquid glucose	5 kg.
Arsenate of soda	200 gm.
Boracic acid	200 "
Borate of soda	200 "
Water to	10 l.

The employment of these insecticides was rendered almost useless, by the continual and abundant rains of the season.

At Coimbre, according to the report the Director of the station at the National Agricultural School, nearly 1500 trees were treated.

For direct spraying, rods of three or four metres in length, adapted for ordinary spraying and used in the northern part of the country for treating vines hung from the trees, were successfully employed.

The difficulty of promptly obtaining shelter for trials of the Lotrionte method, hindered its employment during 1924.

At Borba, the same formulae were tried, but the rains interfered with keeping up these treatments. To apply the Lotrionte method, shelters of sheet iron, tiles and cork were tried, the last being the most economical and suitable for the district.

At Santarem, several trees were treated by employing exclusively the direct spraying method.

At the Silves station, owing to special conditions, chemical treatments were not tried, but sufficient material has been collected to begin new treatments when convenient, and three thousand tiled shelters have been built already for the application of the Lotrionte method.

First studies on the biology of D. oleae and its parasites. — The biological study of *Dacus* and its parasites was started rather too late to be able to estimate the number of "fly" generations in the different parts of the country, and to follow the biology of its parasites.

It is thought that only the eggs of the last but one generation were obtained, the grubs of which hatched towards the end of October.

The number of parasites obtained up till now is still limited. Nearly all these parasites came from olives from the Alémtejo province.

All observations on this subject of view are preliminary, as material arrives every day from different parts of the country.

132. Control of the Olive Fly (*Dacus oleae*) in Portugal.

DE SEABRA, A. F. Instruçoes sôbre os processos acoselhados para combater o Dacus oleae ou Mosca da Azeitona. (Ministério de Agricultura. Direçcão Geral do Ensino e Fomento. Laboratorio de Patologia Vegetal Verissimo d'Almeida), pp. 25, Fig. 8 Coimbra, 1924.

In Portugal, *Dacus oleae*, commonly known as " Moscada azeitona " and wrongly called " Gafa ", a word that should only apply to that disease of the olive resulting from the *Gloeosporium olivarum* Almeida which has for a long time caused great damage — in many cases exceeding 10-15000 contos a year (an equivalent of 56-84 million francs, at par)

The first géneration of the fly, produced by the winter flies, appears at the end of March. The individual flies of this reproduction cause a disease in the olive which increases in intensity as the fruit develops, because of the advent of successive swarms of flies that continue to reproduce until the end of October. During the most prolific period of the propagation of this species, i. e., June to September, the metamorphosis of the insect required 23-25 days (1-2 stage of egg, 12-13 that of larva, and 10 as chrysalis) ; 8 10 days after the appearance of the adult fly the females deposit their first eggs

Nothing has been attempted in Portugal up to the present time to free olive trees from the pest The object of this publication is to diffuse knowledge of methods of combatting the pest by chemical and other means e. g., spraying, immersion, combined spraying and immersion etc., and by natural or biological processes (i. e., making use of the natural enemies of the *D. oleae*) such methods being already well known and largely used in other countries where the olive is cultivated ; they could be improved and applied to the olive in Portugal, and adapted to the conditions of local cultivation. The publication also supplies information regarding the organisation of the artificial means of fighting the disease, the spraying apparatus, and the preparation of insecticides.

Besides directly fighting the insect, it is also imperative to prevent its propagation by eliminating as far as possible, conditions that further its development. There should be mentioned among preventive methods : 1) Scrupulous cleanliness of oil-presses, the lining of their windows with narrow metal nets, in order to prevent the fly larvae from being carried over on the olives, becoming detached from the fruit, and completing development on the spot, and so increasing the numbers of the adult insects. 2) Abolition of the method of beating olive branches ; this results in the scattering of a quantity of larva-laden olives, which, especially when the groves are in close proximity to thick hedges, results in unimpeded development of the larva and propagation of the fly.

G. T.

133 The Control of the "Olive Fly" (*Dacus oleae*) in Cenia (Spain),

La campaña contra la mosca olearia en Cenia *Boletín mensual de olivicultura y elaboración moderna del aceite de oliva*, No 71, p 476 Tortosa, 1924

In 1924 the "Estación Olivarer" at Tortosa, with the aid of the "Consejo Provincial de Fomento" at Tarragona, and with the consent of some proprietors at Cenia, carried on a campaign against the "olive fly" (*Dacus oleae*), applying the spraying method on about 12,000 olive trees divided into 3 lots

In the first lot, situated at a height of 350 metres, the treatment was begun on 2 July For the first four sprayings the ordinary insecticide mixture with a basis of sodium arsenate and molasses was used the fifth spraying was with Bordeaux mixture and the sixth with sodium arsenate All the olive trees, including those of the "Empeltre" variety, which is first attacked by the "fly", bore entirely healthy fruit The few olives which had fallen to the ground had been detached from the tree through the intense drought The arsenic at the strength of 2 ½ parts per 1000 caused some scorching, the solution at 1 ½ per 1000 did not The olives on the property bordering the lot under treatment were damaged by the "fly" to the extent of about 90 % those of the "Empeltre" variety were all attacked about 50 % of the "Marons" variety, very hardy and resistent against the "fly", were attacked

In the second lot 6 sprayings were given rather late, but still in time owing to the slow development of the olives the ordinary insecticide mixture and Bordeaux mixture were used About 3 % of the olives were punctured by the "fly" of the first generation but the punctures completely cicatrised On the holdings in the immediate vicinity, not subjected to the treatment almost the entire crop was lost, it was difficult to find olives which were not worm eaten

In the third lot, which contained as many as 6000 olive trees, sprayings with the ordinary insecticide mixture and Bordeaux mixture were used at the right time it is calculated that not more than 3 per 1000 of the olives were punctured by the "fly" G T

134 *Brassolis istmia*, a. Macrolepidopteron. Injurious to the Coconut Palm and other Plants, in the Republic of Costa Rica.

La plaga de gusanos en la comarca de Limón *Boletín de Fomento*, Year V, No 1, p 68, 2 tab San José, Costa Rica, 1924

At the beginning of July, 1924, there appeared in the neighbourhood of Limón a caterpillar, in all probability imported with vegetables and fruit from Andres Island or from Jamaica, which was recognised as belonging to *Brassolis istmia*

This insect multiplied to an extraordinary extent and its larva fed with great voracity during the night, especially on the leaves of various plants, whereas during the day it remained hidden It prefers the sugar-cane, cocoa tree, coconut-palm, and in the absence of these host plants, the banana

In the absence of adequate means of control it has not been possible to destroy the pest with sufficient rapidity and it has thus destroyed near Limón and Cieneguita, extensive coconut-palm plantations, by devouring the apical bud and the heart the caterpillar has caused the death of the plant.

The Government has organised an energetic campaign and it is hoped that the measures adopted will prevent the propagation of the insect.

G. T.

135. Insects Injurious to the Vine.

VIVARELLI, L. *Entomologia Agraria*, Vol. I. Insetti nocivi alla vite. Second edition (Biblioteca Agraria Ottavi, Vol. CX). XV, 350 pp., fig. 93, Casale Monferrato, Ottavi Bros., 1924.

This is the second edition, — slightly altered and greatly improved by numerous additions, — of the handbook printed for the first time in 1912. It provided the practical agriculturist with a simple and concise guide-book enabling him to distinguish species of insects that do most damage to the vine. After dealing with the general characteristics of insects and their classification, descriptions are given of the principal types of Rhyncoptera, Thysanoptera, Lepidoptera, Coleoptera, Hymenoptera, Orthoptera and Diptera that are injurious to plants · in each case, the best methods of combatting the evil are given, i. e., those that have proved to be most efficacious, easiest of application, and the most economic in practice.

The Appendix gives descriptions of a few acaridae, and of a nematode (*Heterodera radicicola*) and describes methods of control.

G. T.

136. *Franklinothrips myrmicaeformis* n. sp., a Thysanopteron found on the Vine, near Bengasi (Cyrenaica).

ZANON, V. Nuova specie di " Franklinothrips " (Thysanoptera) rinvenuta a Bengasi. Extract from the *Atti della Pontificia Accademia delle Scienze Nuovi Lincei*, Year LXXVII, 9 pp, figs. 3 Rome, 1924

A description of *Franklinothrips myrmicaeformis* n. sp. (Thysanoptera), from the only example found, in August, 1920, on a vine leaf, at Fueihat, near Bengasi (Cyrenaica) The author does not consider this insect injurious to the host plant, but perhaps attracted to it in search of prey, by the presence of *Retithrips aegyptiaca* Marchal, which had for some years infested the vines in the garden where the new representative of the *Franklinothrips* gen. was found and of which only two species are at present known (*Fr. vespiformis* Crawf. and *Fr. tenuicornis* Hood), discovered in some localities in America.

The description of *Fr. myrmicaeformis* is followed by a detailed comparison between the morphological characters of this and *Fr. tenuicornis*, to which the former is similar.

G. T.

137. The Coccid *Chionaspis citri* and its Diffusion in Uruguay.

TRUJILLO, PELUFFO, A. *Chionaspis citri* Const. Cochinilla de los citros. *República Oriental del Uruguay, Ministerio de Industrias, Defensa Agricola, Boletin mensual,* Year V, Vol. 7-8, pp. 109-112, figs. 3. Monte Video, 1924.

Chionaspis citri Const. (*Howardia citri* Berl. and Leon.), which attacks all the aereal parts of the bitter fruits (oranges, mandarins and lemons) is one of the now numerous coccids unknowingly introduced into Uruguay with vegetable products from abroad. Its presence was only reported some years ago in the Republic, where its slight attack was at first limited to the Department of Monte Video. To-day, however, not only are bitter fruits noticed to be much infested on properties in the neighbourhood of Monte Video, but also, in consequence of the rapid diffusion of the coccid across the Uruguayan territory, the parasite is beginning to appear in considerable numbers in the plantations of the principal bitter-fruit zones of the Departments of Salto, Rivera and Cerro Largo.

A description of the species is given.

The first generation of the insect begins to develop, in Uruguay, about the end of September and the beginning of October.

Frequent winter sprayings (3 or 4, at intervals of 15 or 20 days) with " Rubina ", petroleum emulsion and sulphate of lime solution, have been found the most effective against this insect.

G. T.

138. Insects Injurious to Forest Plants in Italy.

CECCONI, G. *Manuale di Entomologia forestale.* Volume XIX+630 pp., figs. 786. Padua, 1924.

The author, who was formerly a lecturer on Zoology at the R. Institute of Forestry at Vallombrosa and the Higher R. Institute of National Forestry at Florence, and is now Director of the R. District Phytopathological Observatory for the Marches, with its head quarters at Fano (Prov. of Pesaro), has completed his Manual of Forest Entomology, which is the first of its kind in Italy ; it was first published in brochure form in 1914.

Besides the introduction and some pages in which the classification followed by the author is set forth, the volume contains seven chapters on, respectively, Orthoptera, Dermaptera, Lepidoptera, Hemiptera, Coleoptera, Diptera and Hymenoptera.

The diffusion of the separate species reported as injurious to Italian forest plants is indicated ; then follow the morphological and biological description of the insects, their habits, ther relations with the plants which harbour them and the natural and artificial means of combatting them.

The volume contains three indexes : one for the insects in question, one for the plants and one for the artificial remedies mentioned or described. 786 illustrations are inserted among the 700 pages of the text.

G. T.

139. The "Gipsy Moth" *(Lymantria dispar)* injurious to the Chestnut in Switzerland.

BADOUX, H. Apparition du bombyce disparate dans un taillis de châtaignier au Tessin *Journal Forestier Suisse*, Year 75, No 11, pp 223-227, 1 fig, 1 Plate Bern, 1924

Liparis dispar (*Lymantria dispar*) has appeared here and there in the forests of Switzerland, but without causing great damage.

After the attacks in 1888 and 1907, quickly stopped in the first case by the effective intervention of the numerous natural enemies of the insect, and in the second by a sudden change of temperature, in consequence of which attacks there was only a loss of growth in beeches and larches, which were deprived of their leaves, the caterpillar of the "gipsy moth" has again appeared in Switzerland, during the summer of 1924, in a copse of chestnuts in the canton of Tessin

All the trees over an area of about five hectares have been completely deprived of their leaves

Owing to the natural enemies of this pest and to the hardiness of the chestnut, the damage has not assumed serious proportions.

G T

CURRENT NOTICES

Legislative and Administrative Measures.

140 **Argentina : Measures of Control against the Pink Bollworm and other Cotton Parasites.** — The " División de Defensa Agrícola, Policía de los vegetales " in Argentina has issued regulations by a Decree of 2 July 1924, relating to the pink bollworm, locally known as " Lagarta rosada " (*Gelechia gossypiella*), to supplement the previous decree of 10 June 1924, published for the same purpose of agricultural protection . The national territories of the Chaco and Formosa and the provinces of Santiago del Estero and Corrientes are scheduled as infested by the " Lagarta rosada " or pink bollworm No quantity of cotton bolls or seed which may be found in these areas may be transported outside the area, unless accompanied by a certificate of health, countersigned by the competent authority, on which it is stated that the seed has been subjected to the processes of disinfection indicated in the regulations Establishments for cleansing and handling cotton bolls or seed must be registered in a special Register of the Department of Agriculture and Agricultural Protection, and equipped with the necessary disinfecting plant, and may not begin work without authorization from the Department which proceeds to hold the required inspection, and on request will supply official plans for the installation of disinfecting chambers The disinfectant recommended by the Government regulations is carbon bisulphide in doses of 400 gm. per cubic metre and left to work for 24 hours at a minimum temperature of 10°C. and if possible at a temperature of from 21° to25°C. The establishments are however authorised to employ modern systems of disinfection other than the official. Government disinfecting stations will be established by the Ministry of Agriculture, when and where considered desirable. Quantities of seed, whether intended for sowing or merely in transit must, be accompanied by a label showing that the necessary disinfection has been carried out. Breach of the regulations of the Decree is punishable with immediate destruction of the seeds or of the whole crop and with withdrawal of the official license granted to the defaulting establishment, without prejudice to the heavier penalties imposed by the Codes.

As regards the methods for prevention and destruction of other cotton parasites, specified in the Decree of 10 June 1924, the instructions, published in the preceding circular No. 180, dated 27 October 1923, by the Ministry of

Agriculture, are made obligatory. (*Ministerio de Agricultura de la Nación, Sección de Propaganda e Informes*, Circular No. 306. Buenos Aires, 1924).

141. **Brazil: Reduction of the Price of Coffee intended for Home Consumption.** — The President of the Republic of Brazil has lately given assent to a law voted by the Congress, giving power to the President himself: to prohibit the export of coffee, up to 5 % of the quantities intended for export preference being given to coffees of grade 7 or inferior grades; to regulate the distribution in the States of Brazil of the quantities not exported, as also the home market prices in accordance with the requirements of consumption in Brazil, as reported in the first six months of the year 1924: and on the question of distribution and of payment to consult with the coffee producing States. (*Brazil Ferro-Carril*, Year XV, Vol. XXVII, No. 373).

142. **Exemptions from Customs Duties for certain Foodstuffs of Prime Necessity.** — A Presidential Decree has been published, exempting from customs duties rice, maize, beans, potatoes, condensed milk, butter, lard and dried meat or " xarque ", with the object of bringing down the prices on the Brazilian markets of these articles for home consumption.

A Bill was also brought forward in the Chamber for exemption in the Customs from the tax of 6 % in gold for the following goods: lard, dried meat, condensed and other forms of preserved milk, dairy butter, fresh fish, fish dried, salt, or otherwise preserved, certain kinds of cheese, fresh or preserved fruits, rice, wheat and wheat flour, maize, potatoes, onions, olive oil, kerosene. (*Brazil Ferro-Carril*, Year XV, Vol. XVII, No 369).

143. **United States: Federal Forest Legislation.** — Measures have been enacted for the protection of forests and the re-afforestation of denuded or non-forested lands, and to ensure the continuous production of timber. The Secretary of Agriculture shall act, as regards the application of the regulations issued, in co-operation with the appropriate officials of each State or of any other public or private body having competence in the matter. Special attention will be given to the protection of forest land from fire, and while in the course of this co-operation with the several States due consideration shall be given to the protection of watersheds of navigable streams, such co-operation may, in the discretion of the Secretary of Agriculture, be extended to any timbered land. Fiscal measures will be prepared designed to encourage the conservation and growing of timber, and methods of insuring standing timber against losses will be investigated and promoted. A sum of 2,500,000 dollars will be appropriated annually to enable the Secretary of Agriculture to carry out the provisions of this legislation.

In co-operation with the various States steps will be taken to procure produce and distribute forest-tree seeds and plants, for the purpose of establishing wind breaks and shelter belts upon denuded or non-forested lands so as to give protection to forest plantations. A further sum of 100,000 dollars will be placed at the disposal of the Secretary of Agriculture for this purpose, and a similar sum will be appropriated for expenditure in assisting owners of farms to improve their land in this way.

For the purpose of regulating watercourses and encouraging the production of timber, the National Forest Reservation Commission shall have power, on the report of the Secretary of Agriculture, who will in this case be assisted by the Director of the Geological Survey, to purchase, on agreed conditions, either forested or denuded lands or other lands.

The Secretary of Agriculture is authorized to accept, on behalf of the United States, from owners of lands chiefly valuable for the growing of timber crops, the title to any such land either as a gift or bequest. Any lands to which title is accepted shall become national forest lands subject to the provisions of the Act of 1 March 1911 and amendments thereto. The donor may in all cases reserve rights in respect of the present stand of merchantable timber or of mineral or other rights on the land so accepted, and for a period not exceeding twenty years.

The President of the United States has power to establish as national forests, or parts of national forests, any lands within the boundaries of Government reservations, other than national parks, reservations for mineral deposits or water-power purposes, national monuments, and Indian reservations (Public No. 270, 68th Congress, H. R 4830 and *International Institute of Agriculture*, Legislative Texts, No. 15, 1924)

144 **United States: Inspection Division Established.** — On August 1st the Secretary of the Interior issued the following order: Effective August 1, 1924: all investigating forces of the several bureaus of the Department shall be consolidated into a division under the office of the Secretary, to be known as the Inspection Division, Department of the Interior. (*New Reclamation Era*, Vol 15, No 9, Bureau of Reclamation, Washington, D. C, 1924)

145 **Madagascar: Regulation of Sericulture.** — A Decree of 2 August 1924 has made regulations for the sale of silkworms, instruction in and study of sericulture, and prizes for silkworm breeders. The sale of silkworms in any part of Madagascar is prohibited except under special license, such license being granted only to persons who are known to be experts in th production of seeds free from disease If necessary the silkworm breeder is required to be able to make examinations under the microscope The breeding bags cannot be offered for sale except with a seal attached bearing the name of the seller and the date of marketing, and they are at any time liable to inspection

Instruction in sericulture is given at the Nanisana Agricultural Station which carries out the investigations necessary for the improvement of sericulture and arranges for the sale of selected seeds, as contained in the breeding bags, at the price fixed by decision of the Governor General. Seeds are also sold under the same conditions by the Antsirabe and Ambatofinandraahna Stations.

A premium is allowed to the breeders of 20 centimes per kg of cocoons sold to the spinning establishments, provided such cocoons have been obtained from seeds coming from the sericultural stations or from authorized sowings. An annual premium of 400 francs is granted to the spinner who produces thread for export, for each tray reeling from more than three filaments and a premium of the same amount is granted to the accessory trays, in the proportion of one accessory for every three trays reeling from more than three filaments and less than six and of one accessory for every two trays using more than six filaments. The annual production of thread must not be less than 60 kg. of raw silk per tray. The Decree is applicable on the provinces of Tananariva, Moramanga, Itaay, Vakinenkaratra, Ambositza and Fianarantsoa. (*Journal Officiel de la Rép. Franç.*, 4-5 August 1924).

146. **Nyasaland : Measures for the control of Diseases of Plants and Animals.** — Order No. 1 containing regulations for the prevention of the introduction and diffusion of plant diseases and pests.. — Order No. 6 relating to the diseases of stock. — Order No. 7 for the protection of wild birds. (*Supplement to the Nyasaland Government Gazette*, Vol. XXXI, No. 1, 1 February 1924).

147. **Latvia : Production of Seed for Sowing.** — The " Instructions relating to the establishment of plots for production of seed for sowing " are as follows :

I. *Establishment of cultivation plots for the production of seeds for sowing.*

(1) Plots for the production of seeds for sowing are established with the consent of the Department of Rural Economy and on the basis of an agreement made between the body establishing the plot and the owner of the land, such agreement to be in writing and a copy sent to the Department

Note. For the purposes of seed production plots farms must be selected when the land is well tilled and highly productive, i e. which yields crops of not less than 18 quintals of rye, 16 quintals of oats or of barley per hectare.

(2) In the agreement the owner of the seed production plot undertakes :

(*a*) to grow on his own farm only the special kind of rye, barley, etc. specified in the agreement, so as to avoid any possibility of mixture ,

(*b*) to restore to the establisher of the proposed plot, that is to say, the supplier of the seeds required, the quantity of seed received with a 25 % addition, after which the selection of the seeds may be made in accordance with the provisions laid down.

Note. For potatoes, a 50 % addition is to be made to the quantity to be restored.

(*c*) to make the selection and separation of the seeds in autumn, before any sales take place and in accordance with the regulations, and then to summon the representative officer of the seed production plot organization, who after having satisfied himself of the state of the seeds thus produced, makes an official report stating the quantity of seed and its grade in purity · a copy of this report must be at once sent to the Department of Rural Economy.

Note. If the organizer of the seed production plot finds that the seeds have not been properly selected, he may require the selection to be repeated till the prescribed grade of purity is attained.

(*d*) to offer for sale, for three years in succession, a quantity of seed, including that returned to the establisher of the plot, 6 times in excess of that received for the purpose of starting the plot.

Note. This amount relates only to cereals

(*e*) to offer for sale only seeds of which the purity ad capacity for germination are guaranteed according to the regulations.

Note Disputes are decided after inspection carried out by the Laboratory of Latvia and by a second Seed Inspecting Officer appointed by the Department of Rural Economy.

(*f*) to plough and attend to the sown fields in accordance with the clauses of the engagement entered into.

(3) The organiser of the seed production plots undertakes:

(*a*) to supply to the owner of the plots seeds in sufficient quantity for the sowing of the special area

Note 1. For seeds of forage crops the area must not be less than one-third of a hectare.

Note 2 No exceptions can be made in this respect, other than with the consent of the Department of Rural Economy.

(*b*) to pay premiums to the owner of the proposed plot For every quintal of cereal seed, sold before 1 March and accepted by the Commission as selected and separated in accordance with the prescribed rules, the premiums are as follows:

First Crop.

7 lats and 50 per cent for selected seeds belonging to choice strains;

(Officials payments are calculated in the projected gold currency, the gold franc (lat) = 50 *Latvian roubles)*

5 lats for ordinary local strains

Second and Third Crops.

5 lats for selected grain of the choice strains:

3 lats and 50 per cent for the ordinary local strains

For linseed

First year, for every quintal of linseed well selected, approved by the Commission and sold	15 lats
for every quintal of ordinary local seed	10 lats
Second year and third year.	
for every quintal of linseed selected and sold	10 lats
for every quintal of local seed	7 lats

For potatoes

First Crop:

for every quintal of selected and choice potatoes	1.20 lats
for local of ordinary quality potatoes	1.00 lats
Second and Third crop:	
selectedand choice potatoes	1 00 lat
local potatoes of ordinary quality	0 50 lat

II *Provision of the Seeds.*

(4) For the establishment of seed production plots, seeds cultivated in Latvia must be employed and selected seeds from other countries, so far as the natural conditions of Latvia allow

(5) The seeds so grown in Latvia may include either selected seeds or local strains if not mixed Seeds from abroad must not show any signs of degeneration.

(6) The Department of Rural Economy is to summon a Commission of Experts to deal with the question of seed production plots and to decide on the kind of seeds which may be profitably cultivated in the different regions in which production plots are instituted

(7) Farmers, etc, possessing good quality seeds of cereals, flax, potatoes,

and other crops, may offer them to the agricultural organizations, supplying the following particulars :

(*a*) District, commune, name of farm and address of the cultivator ;

(*b*) seed licence ;

(*c*) specification of the kinds of seeds intended for sale ;

(*d*) length of time during which certain kinds have been cultivated ;

(*e*) average yield per hectare ;

(*f*) sifters on the farm ; if there are none, the name of the nearest place where there are sifters, with the distance from the farm in question ;

(*g*) roads leading to the farm (and the distance from the railway), this in case of a visit of inspection ;

(8) The agricultural organizations shall forwards copies of this information to the Department of Rural Economy.

(9) In order to ascertain the quality of the seeds offered, a committee of experts belonging to the organization which is to carry on the seed production plots is to carry out a local inspection The day of this visit is to be fixed in advance by agreement with the Department of Rural Economy, in order that a representative of the Department may attend, if necessary

(10) The Committee of Inspection makes an agreement with the owner of the seeds as to their price, in the event of the organization wishing to purchase them with the consent of the Department.

(11) The seeds must be well selected, dried and separated : the extraneous matter present in the case of cereals must not exceed 2 %, in that of clover seed 5 %, and of linseed 3 %. The proportion of seeds capable of germination must not be less than 95 % for cereals, 90 % for linseed and hybrid clover, and 87 % for meadow clover.

The proportion of hard clover seed considered likely to germinate is one-third. Potatoes must weigh from 50 to 100 grammes In potatoes for industrial uses, the proportion of starch must not be less than 16 %, in table potatoes, not less than 12 %.

(12) If the selection of the seeds for the market cannot be made by the cultivator himself, because he has no sifters, he informs the purchasing body of the fact and in that case the purchasers themselves undertake the sifting.

(13) The purchaser and the seller come to an agreement as to the cost of transport of the seeds, the charge for the sacks, etc

(14) As regards the purchase of foreign selected seeds, the parties responsible for the plots make arrangements with the Department of Rural Economy.

III *Supervision and Inspection of the Cultivation Plots.*

(15) The general supervision and inspection of the seed cultivation plots is in the hands of the Department of Rural Economy This Department also controls the activity of the organizations and the establishments which undertake the management of these plots and receive a Government grant for the purpose

(16) If there is any default on the part of the party organizing the plots, whether an institution or a private person, the Department of Rural Economy has power to suspend the payment of the grant and to bring the defaulting party before the magistrate.

(17) The seed growers stand to lose either the whole or a part of their claim

to the grant referred to in § 3, if it becomes necessary on financial grounds to cancel the appropriations proposed and required for the purpose.

(18) Any seed grower who has knowingly effected an admixture or any other fraudulent manipulation of the various kinds of seeds will on the decision of the Inspection Committee be deprived of his license, and compelled, without right of appeal, to refund the grants he has received, the amount of which will be added to that of the State taxes he has to pay.

(19) The Department of Rural Economy fixes the number of the seed cultivation plots to be established on the basis of the sum appropriated for the purpose.

(20) The seed growers are expected to maintain the fertility of the soil and with this object they shall apply for a sufficient quantity of fertilisers, natural or artificial, taking into account the condition of the soil. They are to cultivate the soil in accordance with good farming methods, to select the seeds with every care, and to keep the ground weeded and free from insect pests.

Note. Under 20, more detailed instructions will be issued by the Department of Rural Economy where necessary.

(21) (*a*) The Inspection Committee, which includes 2 or 3 experts who are not interested parties, will visit the farm and satisfy itself as to the state of the sown lands ;

(*b*) The organizations responsible for the cultivation of seeds nominate the members of the Committee who are afterwards appointed by the Department of Rural Economy ,

(*c*) If the Department itself is responsible for the seed cultivation, the members of the Committee are chosen and appointed directly by it.

(*d*) The report of the results of the Inspection must be sent to the Seed Testing Station, and until the institution of this Station, to the Department of Rural Economy

(22) (*a*) The Higher Inspection Committee of the sown lands, which consists of two expert officers of the Department, the director of the Government Selection Station, a representative of the Faculty of Agriculture in the University of Latvia, and of a representative of the Association of Agricultural Officers — the chairman being either the Director of the Department or a person nominated by him — decides on controversial questions and disputes.

Note 1. As soon as the Seed Testing Station is established it will be represented on the Higher Committee.

Note 2 In special cases the Higher Committee has the right to add to its numbers by co-option of competent persons and to summon experts.

(*b*) Payment of the prices reckoned as follows per kilogramme of seeds offered for sale is made for the first three crops of forage seeds :

30	centimes	for	meadow clover
40	"	"	cats' tail grass.
40	"	"	oat grass (*Avena pratensis*).
80	"	"	white clover.
40	"	"	alsike clover (*Trifolium hybridum*).
80	"	"	cock's-foot grass.

(*c*) The owner and the purchaser are to agree as to the price of the seeds.

(*d*) The counterfoils of the receipts issued to the purchasers of seeds form the owner's vouchers for the quantity of seed sold The body organizing the cultivation plots draws up a report showing the names and addresses of the purchasers, the quality and price of the seeds sold The original of this report countersigned also by the cultivating owner must be sent to the Department of Rural Economy, where it serves as the basis for the payments made under the head of premiums

Note. If the owner of the first and second crop has sold a quantity less than that specified in § 2, he forfeits the right to receive premiums for the third crop.

(*e*) If the owner of the seed production plot obtains especially favourable results, the representative of the organization in the presence of two witnesses, including an agricultural expert, makes an inspection of the sown lands, and draws up a report which he presents to the Department of Rural Economy, recommending the owner for honourable mention The Department of Rural Economy receives notice of this inspection two weeks before it takes place, so that, if necessary, a representative of the Department may attend

(*f*) The institution responsible for the seed production plots engages to do its utmost to induce neighbouring farmers to use only the kinds of seeds grown on its model farms, and also organises a succession of seed crops by means of seeds produced on plots already established, and endeavours to obtain general acceptance for the idea of forming agricultural associations for the special purpose of growing these seeds and no others

(23) It is the duty of the Inspection Committee to satisfy itself by means of a visit to the place of cultivation .

(*a*) whether the seeds employed are completely free from impurities and are not mixed with other kinds ,

(*b*) that there are no weed seeds among the seeds ,

(*c*) whether the seeds have germinated satisfactorily and punctually :

(*d*) that the seeds are not attacked by disease, such as *Puccinia, Ustilago,* etc ,

(*e*) that rye and the other cereals are sufficiently protected when flowering against fertilization by other species

If the presence of any factors which tend to prevent the normal development of the seeds is proved, official recognition will not be given to the seed crop. Similarly seeds that have germinated only moderately well are not recognised.

Note 1 Grasses do not constitute a reason for refusal of official recognition, except in the case in which the grasses grow so freely as to overshadow the cultivated plants and interfere with their proper growth

Note 2. Where necessary, the Department will further define clause 23 in detail

(24) If the quantity of seeds not approved exceeds half the seeds grown, the remainder of the seeds of that year will not receive approval and the owner will not have the benefit of a premium If will be the duty of the owner to inform purchasers that the Committee has refused to approve his seeds.

Note If for two successive years the seeds of an owner are not approved, his license will be taken away and he will have no claim to the grants

(25) The names of the owners whose seeds have been approved as satisfactory are published in the daily papers and in the Bulletin of the Department of Rural Economy

(26) The Department of Rural Economy reserves the right to interpret the above provisions

148 **Latvia: Control of the Manufacture and Export of Butter.** — The Latvian Government has passed a law placing butter intended for export under special restrictions The quantity of water contained in the butter must not exceed 16 % The kind of butter and the content in water will be fixed by laboratories to be established for the purpose placed under the Department of Rural Economy of the Ministry of Agriculture Pending the establishment of these Laboratories the Laboratory of the University of Latvia undertakes the analysis of the product On the basis of the results of analysis and also on the basis of the opinion of a committee of experts, the butter is divided into three classes In the first class is placed butter which has obtained from 11 1 to 15 points and is natural butter and containing not more than 16 % of water in the second butter of from 7 1 to 11 points, containing also 16 % of water in the third the product which has been awarded less than 7 points is not natural and contains more than 16 % of water Export of butter of this class is forbidden

Butter which has passed inspection tests and is intended for export must be specially indicated with an inspection mark and the quantity to be exported must not be less than 500 kg The butter factories and private dairies which desire to become exporters of butter must apply for registration with the Department of Rural Economy of the Ministry of Agriculture this Department having the sole right to inspect registered dairies (*International Institute of Agriculture* Legislative Texts No 25 1924)

149 **Rumania: Measures for the Encouragement of Sericulture.** Under the title of Law for the Protection of Sericulture " the *Monitorul Oficial* of 20 April 1924 published a series of provisions relating to the supervision of the production and sale of silkworm seed the planting of mulberry trees and the general encouragement of silkworm breeding

The production of silkworm seed is to be strictly confined to persons, establishments and institutions holding official licenses from the Ministry of Agriculture The only process permitted is the Pasteur Cell or breeding bag process and all breeding is under Government inspection The importation of seed is reserved to the Ministry except in the case of licensed silkworm breeders, who may import the quantity of seed required for their own breeding establishments but even in these circumstances it is always necessary to hold a license from the Ministry In order to restrict absolutely any possibility that silkworms will be reared from seed of ordinary and not first grade strains the right of sale or of free distribution is entirely confined to the Ministry of Agriculture, and to the licensed silkworm breeders Every breeder is expected to sell his surplus cocoons in such proportion as to make up the quantity required by the different establishments

In order to encourage the growing of mulberry trees and to add to their number, the Ministry of Agriculture is forming nurseries of mulberries, attaching them to State establishments, State farms and nurseries, and with the assistance of the Ministry of the Interior is setting up communal nurseries. Mulberry plants so produced are distributed free to silkworm breeders and are also used for planting the roads, the streets, communal pastures and public places in regions favourable to silkworm rearing. Such plantations of public places are declared to be State property and are placed under the supervision and care of the communes, which are also obliged to inform the District Council of Agriculture of the number of mulberry trees standing on their own land, and also the quantity of cocoons obtained.

The Ministry of Agriculture will further proceed to the institution of Sericultural Stations and model silkworm breeding establishments and side by side with these institutions it will establish courses in silkworm rearing, attached to the Lower Schools of Agriculture, designed with a view to the issue of certificates to the students. Ovens will also be constructed for the suffocation of the chrysalids and the drying of the cocoons, and special plants for the selection and better preservation of the cocoons. A certain quantity of the cocoons collected by the Government will be distributed by the Ministry of Agriculture at cost price to persons establishing new spinning mills of from one to 10 trays, and money prizes will be awarded to the best breeders and also bursaries for special study abroad. A Special Sericultural Service has been instituted under the Ministry constituted as follows: 1. a body of special officials; 2. advisers in agriculture and regional experts; 3. the communal auditors, notaries and secretaries; 4. other officers of the same Ministry with special powers in case of need.

150. **San Salvador: Measures for the Encouragement of Agriculture.** — Decree approving the Convention of Central America for the institution of Agricultural and Zootechnical Experiment Centres. — Decree granting premiums to growers of maguey. (*Diario Oficial*, No. 99 and 119, 1924).

151. **Kingdom of the Serbs, Croats and Slovenes: Seed Selection and Viticulture.** — In the *Sluzbene Novine* (Nos. 12 and 59 of 1924) the following have been published: a regulation as regards the establishment and working of stations for the selection of seeds intended for sale and supplies, a regulation issued in pursuance of articles 3, 6, 8, 10, 18, 19 and 23 of the law 31 December 1921 (See *Annuaire International de Législation Agricole* 1922, pp. 221 224) dealing with the improvement and encouragement of viticulture; and finally a regulation on the wine-making stations on the lines of the law of 31 December 1921 quoted above.

152. **Switzerland: Legislative Measures against Cattle disease.** — A Federal Decree prohibits, pending further legislation, the importation of cattle whether for breeding or for dairy purposes except in special cases when licenses to import animals may be given in the interests of instruction in stockbreeding, and improvement of breeds. Special regulations are laid down in regard to the bringing into Switzerland of butchers' beasts or fresh meat, which is prohibited when the conditions of the country from which the animals or meat come are such that there would be a risk of bringing cattle disease into Switzerland, or speading disease in that country. (*Recueil des Lois Fédérales*, No. 16, 11 June 1924).

Experiment Stations and Agricultural Instruction.

153. **The Pan-Pacific Research Institute.** — The Castle Home, in Honolulu, is to be transformed into a scientific institute known as the Pan-Pacific Research Institute. The students of the Institute will, it is expected, attend the University of Hawaii, where they will take their degrees.

This institution will form the nucleus of the Pan-Pacific University, for which a charter was granted some years ago. This will be a graduate university, chiefly for research work. The work of the Institute itself will be along lines of research study of the food resources of Pacific lands and of the ocean itself. It will be connected with no other body, but will co-operate with kindred institutions in all Pacific lands. It will be neither American, Hawaiian nor Japanese, but governed by scientists from all the Pacific regions.

The Castle Home will have accomodation for about forty workers, students and staff, and some forty visiting research scientists, and will be provided with a large annexe specially planned for laboratory uses. There will be also other smaller buildings and a good supply of water for laboratory purposes. (*Science*, New Series, Vol LX, No. 1548, 1924).

154. **Germany: The Higher Horticultural Institutes of Berlin-Dahlem, Geisenheim am/Rhein and of Proskau.** — The *Landwirtschaftliche Jahrbücher* publish in full, three reports on the work of these three institutes for the years 1922-23. The report of the *Hohere Gartnerlehranstalt* of Berlin-Dahlem has been prepared by the Director Professor ECHTERMEYER and includes: *A*. Report on administration and instruction; *B*. Report on the technical work; *C*. Report on the scientific work. Professor **MUTH** is responsible for the report of the *Hohere staatliche Lehranstalt für Wein- Obst- und Gartenbau* of Geisenheim am/Rhein, which is in four parts, viz. I. Details of the number of students, etc. II. Internal Activity of the Institute; III. Activity of the Scientific Section IV. Work of the Vine Grafting and Improvement Station of Geisenheim

The report on the Proskau *Hohere staatliche Lehranstalt für Obst-und Gartenbau* has been compiled by the Director, Herr ZEININGER, and is divided into three parts: *A*. General: *B*. Technical work; *C*. Scientific Worl

155. **Austria: Experimental Station of Agricultural Chemistry Imst. Tyrol.** — This station has been lately established and attached to the Imst Agricultural Institue. It is carried on as an institution for joint research and conducts practical as well as purely theoretical experiments. Analyses of agricultural products of any kind are undertaken for agriculturists on application. (*Chemiker-Zeitung*, Year 48, No. 146, 1924).

156. **Belgium: Agricultural Education in Belgium** — The Belgian Minister of Agriculture and Public Works has presented to the Legislative Chamber a triennial Report (1921-23) relating to the position of agricultural education in Belgium. The Minister states that the triennial period covered by the Report has been especially characterized by the extension of agricultural education of the intermediate and primary grades. The most important steps taken have been: the independent powers secured by the law of 26 December 1923 to the farms attached to the Lacken *Institut Supérieur d'économie ménagère agricole* to the Vildeverde *Ecole d'horticulture*, and to the *Ecole moyenne pratique d'agri-*

culture at Huys, and also the inauguration of training courses for the teaching staff of the different categories of schools.

In the three years the total credits voted by Parliament for agricultural education have been apportioned as follows : instruction in agriculture 4,940,918 francs ; publicity vork 5,628,731 francs, subsidiary institutions 5,348,130 francs. Agricultural education has not only helped to bring about an improvement in the conditions of rural life, but also has had an effect on agricultural production, by making more widely known the advantages of chemical fertilisers, by encouraging the formation of credit and mutual insurance associations, of breeders' societies, and of societies for joint purchase and sale, etc.

A number of appendices are attached to the report dealing with the following subjects: I The Higher Council for Improvement of Instruction in Agriculture and Horticulture ; II Agricultural Instruction for young stockfarmers ; III. Farmhouse management instruction ; VI. Instruction in horticulture ; V. Institutions closely connected with agricultural education.

For the purposes of higher agricultural education the two Government insstitutions ; are recognised, viz. the **Gembloux** *Institut agricole de l'Etat* and the Ghent *Institut agronomique de l'Etat* ; for intermediate education, the *Ecole moyenne pratique d'agriculture d'Etat* at Huys, the schools and agricultural sections not under State management but in receipt of grants, the courses in scientific agriculture at the high schools, at the government intermediate schools and at the non-government institutions for intermediate education ; for elementary education, the vocational agricultural sections for boys in the primary schools, the schools of farm engineering and the seasonal agricultural courses for youths ; and finally for popular instruction , the lectures given the Government agricultural experts, the lectures on agriculturefor adults, the courses in agricultural science for ex-service men, poultry-keeping and bee-keeping courses, demonstrations in the proper rationing of live stock, the experimental plots and the agricultural libraries

As regards instruction in farm household management different grades of instruction are proposed as follows: higher instruction (the Laeken *Institut normal supérieur d'économie ménagère agricole*), intermediate instruction, primary instruction (young girls' courses, and travelling schools), and popular instruction (Women Advisers on Farm Household Management), *Conseillères ménagères agricoles*).

Intermediate and higher instruction in horticulture is given by the Government Schools of Ghent and Vilvorde and by the grant aided schools of Carlsburg, Liège, Tournai, Wetteren, Hechtel, Louvain, La Hulpe, Mariemont and Bons, while lower intermediate instruction is given chiefly in the agricultural seasonal schools and in the vocational horticultural courses. There are also horticultural courses complete in two lessons, lectures on pomology and on fruit-growing in general: a Service of Horticultural Advisers (*Conseillers d'horticulture*) has been is instituted, and a large subsidy towards these branches of instruction is given by the Government Botanic Gardens.

Institutions closely connected with agricultural education are also dealt with in the report in a special appendix classified under the following Stations: (*a*) agricultural chemistry and physics ; (*b*) the dairying industry ; (*c*) phytopathology ; (*d*) agricultural entomology ; (*e*) rural engineering ; (*f*) for the improvement of seeds; (*g*) experimental agriculture at Hasselt; (*h*) forestry; (*i*) seed-testing at Louvain.

The report contains about fifty illustrations showing school buildings laboratories, experimental demonstrations, etc. (*Situation de l'Enseignement Agricole.* Rapport triennial présenté aux Chambres législatives par Monsieur le Ministre de l'Agriculture et des Travaux Publics, 1921, 1922, 1923).

157. **Brazil: Two new Experimental Stations.** -- A new Experimental Station is to be established in the municipality of Porto Felix (State of São Paulo) to be usd for investigations into questions of cotton-growing, and a second in the State of Bahia for experiments in the cultivation of cacao. For the latter Station the Government has purchased the estate "Pancada Formosa". (*Brazil Ferro-Carril*, Year XV, Vol. XXVII, No. 372).

158. **Spain: Popular Agricultural Instruction at Madrid.** — An announcement of a short course of agriculture appears in a recent number of the *Madrid A. B. C.*, to be held in the *Casa de Campo* from 1 February to 10 March of this year for young people of both sexes over 14 years of age, who have passed through the elementary school. A course on similar lines will follow from 17 March to 1 May dealing with the care and feeding of live stock with special reference to the more fundamental requirements of hygiene and sanitation and in addition instruction in the first principles of cheese-making will be given. A third course on poultry and bee-keeping will take place from 1 April to 1 May. The general Association of Spanish Stockbreeders (*Asociación General de Ganaderos*) is responsible for establishing these courses.

159 **United States: The Fiftieth Anniversary of the Forest Experiment Station at Colorado Springs.** — The Fremont Forest Experiment Station, which was established by the United States Department of Agriculture at Colorado, celebrated its fiftieth anniversary in 1924. It is the second station of its kind established in the western forest regions of the country, and has for a number of years been conducting a number of laboratory experiments. The field depot of the station is on Mount Manitou. Besides the laboratory experiments, a considerable part of the work of the station is distributed over the national forests of Colorado, Wyoming, South Dakota and Nebraska, where field tests are made and permanent plots established to determine the best practical methods of re-afforestation, the rate of growth of stands, the best methods for thinning stands and for obtaining natural regeneration of forests. (*Science*, N. S, Vol LX, No 1500, 1924)

160. **Forest Experiment Station in the Pacific Region (United States).** — The Forest Service of the Department of Agriculture of the United States has established another Experiment Station in the North-West region of the Pacific Coast, on similar lines to that lately opened in 1923 in the North-East regions and the Lake States. (*Experiment Station Record*, Vol. 51, No. 2, Washington, 1924).

161 **Scientific Methods of Forestry in the Harvard Forest, Petersham, U. S. A.** - To observe scientific methods of growing timber crops as developed during the past 15 years in the historic Harvard forest at Petersham, the North-eastern Forest Research Council and a Committee of the pulp and paper industry met there on September 4 and 5. The Research Council was appointed by WALLACE, Secretary of Agriculture, in the previous winter, for the

purpose of promoting forest research and of working out more reliable methods of growing timber in the forests of the Northeast of the United States. This Committee is acting in an advisory capacity to the Northeast Forest Experiment Station, forest schools, State forestry departments and other forest research agencies in the northeast. In addition to studying the successful forestry operations carried out by Harward University on intensive methods of forestry management, the conference also discussed present and proposed forest research programmes, the sites for substations, and the Clarke Mc Nary forestry bill passed by the last session of the Congress. (*Science*, N. S., Vol. LX, No. 1655, 1924).

162. **United States : Lehigh Research Institute.** — The Lehigh University has established the Lehigh Institute of Research, under the management of a Board of Directors of which each man is an authority in his special field. One of the objects of the new Institute is to afford training in reaserch to various classes if individuals who have received a scientific education. (*Refrigerating World*, Vol. 59, No. 10, p. 16. New York, 1924).

163. **Course of Lectures at the Pittsburg Industrial Research Institute. (U. S. A.).** — A course of lectures is being held for the academic year 1924-25, at the Mellon Institute of Industrial Research, which is attached to the University of Pittsburg. It covers a number of subjects, dealing with raw materials, manufacturing, transformation processes, properties and uses of products of technical chemistry. Among the lectures which deal with branches of agriculture the following may be mentioned: Insecticides and fungicides (O. F. HEDENBURG) ; fertilisers (H. N. MYERS) ; timber preservatives (A. M HOWALD) ; Rubber (H W. GREIDER) ; sugar (D. K. TRESSLER) ; cereal products (H. A. KOHMAN) : preserved foods (E. R HARDING).

164. **Colorimetry at the National Bureau of Standards in Washington, D. C.** — The Munsell Research Laboratory of Baltimore has established two positions of research assistant in colorimetry to be stationed at the National Bureau of Standards at Washington, D C. The chief purpose of these assistantships is to provide for training suitably qualified young men in the practice, technique, and theory of colorimetric measurements, in order that they may become eligible for posts of responsibility in connection with work of this kind. These assistants will work in the Section of colorimetry of the Bureau of Standards, and will be in close contact with the work of the Section, and will have unusual opportunities of learning by experience, observation and conference with other members of the staff. The work of the Section includes spectrophotometry by various methods, colorimetry and research in visual psycho-physics. The chief duties attaching to these posts will be to assist in research and testing involving the use of the spectrophotometre, the monochromatic colorimeter and various other photometric and colorimetric instruments used in testing and research. (*Science*, N. S., Vol. LX, No. 1557, 1924).

165. **Official Agricultural Institutions at Haiti.** — The Technical Bureau of the Department of Agriculture, for which an appropriation of $170,000 has been made, is now being organized. A Central Section will be instituted for the training of technically educated men for Government and other service, and of teachers for agricultural schools. There will also be a central experimental station and branch experimental and demonstration farms will

be organized in localities especially adapted to coffee and cotton production and cattle raising. The bureau will inaugurate work in forestry and the conservation of forest products. (*Bulletin of Pan-American Union,* July 1924).

166. **Elements of Agriculture for the Lower and Rural Schools of Haiti.** — A hand-book entitled "*Premiers Elements d'agriculture à l'usage des écoles primaires, urbaines et rurales*" has been published by Dr. DALENCOUR, one of the leading doctors of Haiti. The book is about a hundred pages long, is written in a clear style, suitable for young readers, and covers all that is necessary for them to know of the first principles of agriculture, with special regard to the agricultural conditions of Haiti. Elements of physics, chemistry, meteorology, botany and geology are simply explained, then follows the elementary principles of improvements, drainage, irrigation, the preparation of agricultural land, fertilisers and schemes of rotation of crops. Special attention is naturally given to the crops of Haiti, rice, maize, cotton, banana, coffee, cacao, tobacco, etc. and they are treated at some length, while plants used in the dyeing or tanning industries, and medicinal plants are not neglected. Chapters are given to cereal cultivation, forestry, horticulture and fruit-growing, as well as to the oil-yielding plants, forage plants, rubber, etc. The manual concludes with notes on the breeding of animals (including bee-keeping and pisciculture), farm book-keeping and Haitian rural economy. (DALENCOUR F Premiers éléments d'agriculture à l'usage des écoles primaires urbaines et rurales. 16mo, pp. 110. To be obtained from the author, Port-au-Prince).

167 **Model Farm in Panama.** --A contract has been drawn between the Secretary of Public Works of the Panama Government and Walter C. Staton for the operation of a model farm in the district of Alanje, Chiriqui Province, where 18 students, two from each province, are to receive instuction in agricultural work. Cultivation and improvement in the methods of raising rice, corn, beans, sugar cane, bananas, tobacco, and other tropical fruits and vegetables, as well as feed and forage for cattle, are among the principal subjects in which instruction is to be given. Attention will also be given to proper methods of caring for livestock and the use of modern agricultural machinery.

Under the terms of the contract, which is for the period of one year from April 15, 1924, but renewable for an addtional five years, the contractor is to receive the sum of $36 a month for each student.

The Government reserves the right to establish an agricultural experiment station, not to exceed 10 hectares (about 25 acres) in area, within the limits of the model farm and to place in charge an expert to be appointed by the Government, if desired.

168. **France : Vocational School for Shepherds at Rambouillet.** — This school is attached to the *Bergerie Nationale* at Rambouillet. Training is undertaken of: (1) shepherds who have good practical experience and can give all the attention required to the profitable management of the flock, and at the same time are capable of understanding the various systems of sheep-farming and of giving skilled assistance when necessary; (2) shepherds who can farm at a profit flocks put under their care or which they may farm for themselves. For information, apply to the Directeur de la Bergerie, Rambouillet (Seine et Oise), France. (*Bulletin de la Société des Agriculteurs de France,* p. 215, 1924).

169. **The Microbiological Course at the Pasteur Institute, Paris.** — This course opened on 5 January of this year and will continue till 12 April. It is intended especially for doctors, veterinary surgeons and biologists who desire to obtain a complete training in protozoology and in bacteriology. The teaching staff includes some distinguished names in the different subjects: CALMETTE, DUMAS, LEGROUX, POZERSKI, VALLÉE, TISSIER, MORAX, DUJARDIN-BEAUMETZ, SERGENT, COLONI, DOPTER, SALIMBENI, BORREL, LEVADITI, PETTIT, WEINBERG, LOISEAU, MARCHOUX, MESNIL, ROUBAUD, MARIE, CH. NICOLLE. In addition to subjects relating to the theory and the general technique of microbiological work, and those which bear on human and animal pathology, attention is being paid to agricultural microbiology, micro-organisms of the soil and of the residual waters etc. and the syllabus of work is so far extended as to cover questions relating to the phycomycetes, the ascomycetes, and the hyphomycetes, and the *fungi imperfecti*.

170. **Great Britain. Agricultural Education and Research.** — The Government has decided to provide another £500 000 for agricultural education and research, in addition to the funds already available for that purpose (amounting to £1 000 000) under the Corn Production Act, 1921, and about £400 000 from other Governments. The new sum is for use during the next five years. (*The Agric. Gazette and Modern Farming*, Vol. C, No. 2647, 1924).

171. **Dairy Experimental Institute at Reading, England.** — This National British Institute was founded in 1912 and new buildings have lately been added to the special Station at Shinfield, near Reading, thus providing an experimental farm, chemical and bacteriological laboratories, etc. The Institute possesses a library of 2000 volumes on which £30 000 sterling have been spent. (*Chem. Zeitung*, Year 48, No. 146, 1924).

172. **Agricultural Experiment Stations in Canada. (Report of Director of Agriculture for year ending March 31, 1924).** — The *Report* covers the work for the past year, of the Central Experiment Farm, Ottawa, and the numerous Branch Farms and Stations throughout the Dominion. (Ministry of Agriculture, Ottawa, Dominion of Canada, 1924).

173. **Phytopathological Laboratories in Canada. (Report of the Dominion Botanist for year ending March 31, 1924).** — The *Report* covers the work carried out during the year at the Central Laboratory, Ottawa, and the various phytopathological laboratories of the Dominion. An account of forest tree diseases is included. (Ministry of Agriculture, Ottawa, 1924).

174. **Canada: Reports of the Chief Supervisor on the Illustration Stations for 1923.** — The *Reports* are two in number, the first dealing with the work of the Illustration Stations in Ontario, Quebec, New Brunswick, Nova Scotia and Prince Edward Island; the second covers the work of the Stations in British Columbia, Alberta and Saskatchewan. (*Ministry of Agriculture*. Ottawa, 1924).

175. **Foundation for Agricultural Experiment and Research in Italy.** — The purposes for which this Foundation has been inaugurated in Rome and converted into an independent institution with corporate rights by a Royal Decree of 15 August 1924 are: (1) to make grants to the Agricultural Experiment Stations with a view to the encouragement of their development

and the due co-ordination of their activities; (2) to provide the funds required for the working of an Institute of Agricultural Economics and Statistics, set up by Decree of 30 December 1923. The capital of this Fund is formed from the funds of the suppressed Institute of Dairying, Agriculture and Stockbreeding at Rome, together with any funds that may possible be assisgned to it at a later date. (*Gazzetta Ufficiale*, 4 October 1924; *Bollettino del Minis ero dell'Economia Nazionale*, Year 2, No. 2, 1924).

176. **Transformation of the Royal Experimental Wine-Making Depots of Barletta, Velletri and Noto.** — These institutions were by Royal Decree of 19 June 1924 transformed into self-governing consortia with corporate existence. (*Gazzetta Ufficiale*, 4 July, 1924).

Associations and Agricultural and Scientific Institutions.

177. **France: International Bureau of Epizootics.** — By the decision of the International Conference which met at Paris in 1921, it was resolved that an International Bureau should be established in Paris to consider control measures for infectious diseases in animals. The main lines of the work of this Bureau were defined by the Conference, and M. M. LUTRARIO, POITEVIN and LECLAINCHE were instructed "to place themslves at the disposal of the competent French authorities to assist in the formal drawing up of the scheme as agreed upon.

Acting on these instructions, LECLAINCHE prepared a draft constitution which was submitted to the Ministry of Foreign Affairs which undertook to obtain the support of the Foreign Governments. Negotiations were actively pushed forward in view of the time necessarily entailed by correspondence through diplomatic channels with States in different parts of the world. At the beginning of the present year a number of States had signified their support so that it was possible to draw up the International Agreement the text of which is given below, as also that of the definitive Statutes.

Forty-two States took part in the Conference of 1921, and twenty-eight have already agreed to take part in the establishment of the Office while the adhesion of others is expected. India and Ireland have already signified their acceptance of the Agreement. The suggestion made by the Conference of 1921 that the new office should be attached to the International Bureau of Public Health has not been adopted, in consequence of reservations made by some of the States adhering to the latter. The International Bureau of Epizootics has thus full independence. A bill will be introduced as soon as possible for the ratification of the Agreement which has been concluded and the whole scheme will very shortly be carried into effect.

INTERNATIONAL AGREEMENT FOR THE FORMATION AT PARIS OF AN INTERNATIONAL BUREAU OF EPIZOOTICS. — The Governments of the Argentine Republic, of Belgium, Brazil, Bulgaria, Denmark, Egypt, Spain, Finland, France, Great Britain, Greece, Guatemala, Hungary, Italy, Luxembourg, Morocco, Mexico, the Principality of Monaco, the Netherlands, Peru, Poland, Portugal, Rumania, Siam, Sweden, Switzerland, the Republic of Czeco-Slovakia and the Regency of Tunis, being of opinion that it is desirable that an International Bureau of Epizootics should be organised on the lines laid down in the resolution passed by the International Conference for Epizootics, on the 27th May, 1921, have decided to conclude an agrreement to the following effect.

Art. 1. — The High Contracting Parties pledge themselves to found and maintain an International Bureau of Epizootics with headquarters at Paris.

Art. 2. — The Bureau works under the authority and control of a Committee composed of the Delegates of the contracting States. The composition and competence of this Committee, as well as the organisation and powers of the Bureau itself, are defined by the Articles of the Constitution attached to the present agreement and of which it is to be regarded as forming an integral part.

Art. 3. — The initial expenses of establishing this Bureau as well as the initial cost of working and maintenance are met by the contributions of the contracting States which are fixed in accordance with the conditions specified under the Articles of Constitution referred to in Article 2.

Art. 4. — The sums representing the contributions of each of the contracting States are paid by them, at the beginning of each year, through the Ministry of Foreign Affairs of the French Republic, into the *Caisse des Dépôts* at Paris, whence payments will be made as required on the order of the Director.

Art. 5. — The High Contracting Parties reserve to themselves the right of introducing, by common consent, into the present Agreement, any modifications which experience proves to be necessary.

Art. 6. — The Governments who are not signatories of the present Agreement may become so on application. Such adhesion shall be notified through the diplomatic channels to the French Government, and by it to the other contracting Government, and this adhesion will carry with it the obligation of contributing to the expenses of the Institute, under the conditions specified in Art. 5.

Art. 7. — The present Agreement will be ratified under the following conditions:

Every power shall send its ratification with the least possible delay to the French Government whose business it will be to inform the other signatories.

The ratifications will be deposited with the archives of the French Government.

The present Agreement will come into force, for each signatory country, on the day on which that country deposits its deed of ratification.

Art. 8. — The present Agreement is concluded for a period of seven years among the States which shall not have given notice a year before the expiry of any period of their intention of withdrawing them.

In pledge of which the undersigned, being duly authorised, have made the present Agreement in single copy to which they have attached their signatures: this copy will deposited in the archives of the French Government and copies of it will be sent by diplomatic channels to the Contracting parties. The said copy may be signed up to 30th April, 1924, inclusive.

(Signed by the Delegates of various countries).

THE ARTICLES OF CONSTITUTION OF THE INTERNATIONAL BUREAU OF EPIZOOTICS.

Art. 1. — The International Bureau of Epizootics is instituted at Paris in dependence on the States who agree to participate in its working.

Art. 2. — The Bureau may not concern itself in any way with the internal affairs of the various States.

It is independent of the Authorities of the Country in which it is instituted.

It is in direct correspondence with the Higher Authorities of Services which in the different countries are responsible for the sanitary measures in regard to animals.'

Art. 3. — The Government of the French Republic on the request of the International Committee referred to in Article 6, will do all that is necessary to obtain recognition of the Bureau as an institution of public utility.

The principles of the Bureau are the following:

(*a*) To encourage and coordinate all forms of investigation and experiment, relating to the pathology and the prophylaxis of the infectious diseases of animals, for which purpose it may appeal for international co-operation.

(*b*) To collect and report to the Governments and their Health Departments facts and documents of general interest concerning the occurrence of the epizootic diseases and the control measures adopted.

(*c*) To consider drafts of international agreements relating to sanitary measures in regard to animals and to place at the disposal of the Governments which have signed such conventions the means of supervising their execution.

Art. 5. — The Governments shall send to the Bureau:

(1) By telegraph, notification of the first cases of cattle plague or epizootic foot-and-mouth disease reported in any country or district hitherto immune.

(2) At regular intervals, bulletins in accordance with a model adopted by the Committee with information on the existence and the extent of the diseases enumerated in the following list. Rinderpest, foot-and-mouth disease, contagious pleuro-pneumonia, anthrax, sheep-pox, rabies, glanders, malignant coital disease, swine fever

The list of the diseases for which one or the other of the preceding clauses are applicable may be revised by the Committee subject to the approval of the Governments.

The Governments shall notify to the Bureau the measures which they are taking to control epizootic diseases, especially those which they are adopting at the frontiers to protect their own territory against introduction of such diseases from infected countries. As far as possible they will reply to requests for information which are referred to them by the Bureau.

Art. 6. — The Bureau is placed under the authority and the Control of an International Committee which is composed of representative technicians appointed by the contracting States in the proportion of one representative for each State.

Art. 7. — The Committee of the Bureau shall meet periodically at least once a year. No limit is placed on the duration of these meetings. The Members of the Committee elect by ballot a chairman who remains in office for three years.

Art. 8. — The working of the Bureau is carried on by a salaried staff including:

(1) The Director;

(2) Technical Officials;

(3) The necessary office staff.

The Director is appointed by the Committee.

The Director is present at the meetings of the Committee and has a consultative vote. The appointments and the dismissals of the employees of any category rest with the Director who is responsible in this respect to the Committee.

Art. 9. — The information obtained by the Office is reported to the contracting State by means of a bulletin and special communications which are forwarded either officially or on request.

The notifications relating to the first cases of rinderpest or epizootic foot-and mouth disease are transmitted by telegraph, as soon as received, to the Governments and the Health Departments.

The Bureau publishes regularly the results of its activities by means of official reports communicated to the contracting States.

Art. 10. — The Bulletin which is published at least once a month includes :

(1) The laws and the general and local regulations published in the various countries relating to the transmissible diseases of cattle :

(2) Notices on the occurrence of infectious diseases of animals ;

(3) Statistics relating to the health conditions of the world's live stock.

(4) Bibliographical notices

The official laguage of the Bureau and of the bulletins is French. The Committee may decide what parts of the bulletins shall be published in other languages.

Art. 11. — The necessary working expenses of the Office are borne by the signatories of the Agreement, and by those who shall subsequently adhere to it ; the proportion of the contributions is fixed in accordance with the following groups :

Group	I,	in the ratio of	25	units
"	II,	" "	20	"
"	III,	" "	15	"
"	IV,	" "	10	"
"	V,	" "	5	"
"	VI	" "	3	"

on the basis of 500 francs per unit.

Each State is free to chose the group in which it elects to be placed It is open to any State to transfer to a higher group subsequently.

Art. 12. — A sum is set aside from the yearly receipts for the formation of a reserve fund. The amount of this reserve, which must not exceed the amount of the yearly balance, is invested in State funds of the first rank

Art. 13. — The members of the Committee receive an indemnity from funds assigned for the working expenses of the Office. They also receive a voucher of attendance for every meeting of the Committee which they attend

Art. 14. — The Committee fixes the sum to be set aside each year out of the balance as a contribution to a pension fund for the staff of the Bureau.

Art. 15. — The Committee votes the annual budget statement of accounts, and approves the expenditure. It also establishes the staff regulations, and makes all the arrangements necessary for the working of the Bureau

The regulations and provisions referred to are communicated by the Committee to the contracting States and cannot be modified without their consent.

Art. 16. — A report of the administration of the Bureau is presented every year to the contracting States after the close of the financial year.

178. **Committee on Social Welfare and Agriculture in Colombia.** — The Colombian Parliament has appointed a committee of its members for the purpose of preparing and presenting a bill containing practical legislation on such problems as wages, workers accidents, health measures in factories and commercial establishments, medical attendance for workers, etc. The Committee will also prepare a bill on the legislation which should be adopted in order to develop the national resources of the country to better advantage, and to provide adequate means of establishing credit for the benefit of the farmer. (*Bull of the Pan-American Union*, Washington, D. C., May 1924).

179. **National Institute for Colloid Research in the United States.** -- The National Institute, founded under the auspices of the National Research Council, will form a part of the University of Wisconsin There is a capital appropriation of a million dollars, which, by providing fully equipped laboratories, will enable 40 to 50 persons to carry on research work. The annual upkeep and the salaries of the directors, the assistants and general staff is calculated at from 37,500 dollars, and in addition 10,000 dollars will be set aside each year for the purchase of new apparatus. The Institute will be governed by a Committee of 7 members, two of which will be appointed by the University of Wisconsin, and the others respectively by the National Research Council, the American Chemical Society, the Federation of Societies of Biology and Experimental Medicine, the American Society of Physics and also by the donors (*Revue Générale des Colloïdes*, Year 2, No 9, Paris, 1924)

180 **The Centenary of the Franklin Institute and of the Rensselaer Polytechnic.** The centenary of the Franklin Institute was celebrated at Philadelphia on 17-19 September 1924 Some of the most distinguished specialists in physics and engineering were among those present, or otherwise gave their support. On 3-4 October there was celebrated the centenary of the Rensselaer Polytechnic Institute, another of the oldest of the scientific and engineering colleges founded in Anglo-Saxon countries

181 **The American-Albanian College of Agriculture and Trade.** — The Albanian Government has made a grant of 1200 hectares of land to a new American College which takes the title of the American-Albanian College of Agriculture and Trade. (*Science*, N. S., Vol. LX, No. 1550 1924)

182. **Poultry keeping in Algeria.** — A Poultry Breeding Society has been formed in Algeria of which the objects are: the protection of the general interests of poultry raising as an industry, as an agricultural resource and as a hobby; the study and valuation of the different breeds of poultry, as also of methods of breeding and production; the improvement of the strains of farmyard animals, fowls, pigeons, rabbits, etc; discovery and care of ornamental small birds suitable for aviaries; the increase and protection of birds useful to the farmer; and the encouragement of birds suitable for restocking game preserves. (*Revue Agricole de l'Afrique du Nord*, Year 22, No. 269. Algiers, 1924).

183. **Progress of the Empire Cotton Growing Corporation.** — At the general meeting of the Empire Cotton Growing Corporation held on 23 October 1924, a report was approved which dealt with the activity of the Corporation in India, Australia, South Africa, Soudan, Uganda, Tanganyka,

Nyasaland, Nigeria, East Indies and Ceylon. There was also a discussion of the new quarterly Review of the Corporation, " The Empire Cotton Growing Review ", on instruction and experimental work in cotton-growing, on the question of transport and on the British Empire Exhibition. (Empire Cotton Growing Corporation, Millbank, London, 1924).

184. **The Work of the Department of Agriculture of the Straits Settlements and the Malay States.** — In the August 1924 number of the *Malayan Agricultural Journal* of Kuala Lumpur (Vol XII, No. 8), there are published the reports of the various Directors of the different sections and services of the Department, viz. the Inspectorate, the sections of Chemistry, Economic Botany, Plant Physiology, the Mycological, Entomological, Agricultural Plantations, and Practical Agricultural Services.

185. **The Institute of Agricultural Economics and Statistics in Italy.** — The *Gazzetta Ufficiale* of 18 November 1924 publishes the terms of the constitution of the Institute of Agricultural Economics and Statistics, attached to the Ministry of National Economy with the following bureaux:

(1) A Central Bureau of Agricultural Statistics attached to the Department of Agriculture ; (2) A Bureau of Forestry Statistics, the necessary funds for which will be appropriated in the budget of the State Forest Estate, (3) a Bureau for agricultural economic investigation.

The following are the functions to be fulfilled by the Institute, and allocated to the different bureaux according to subject: (*a*) to make the yearly agricultural and forestry statistical returns, and to arrange for the compilation, bringing up to date and publication of the agricultural and forestry cadastral survey ; (*b*) to initiate and carry out enquiries and studies in agricultural and forestry economy ; (*c*) to encourage — in accordance with the lines already laid down — the gradual establishment of the farm accountancy offices, and to draw up statistics from the material thus supplied ;(*d*) to direct and co-ordinate the work of any observers or institutions of rural economy in any area, or region of Italy.

A Technical Committee which transacts its business at the Ministry of Agriculture is responsible for the administration of the Institute.

Local investigations and correspondance will be carried on by the Institute in the following way : (*a*) the Economic and Statistical Sections of the Provincial Agricultural Councils, wherever instituted, will act through Provincial Commissioners for agricultural and forestry statistics. Failing these the Travelling Lectureships of Agriculture, or other bodies deputed by them, will act for agricultural statistics, and the Forestry Inspectorates, for forestry statistics; (*b*) offices of farm accountancy in receipt of grants from the Institute will be locally established with a programme in accordance with the rules laid down by the Institute; (*c*) either Higher Institutes of Agriculture attached to the Chairs of Rural Economy, or Agricultural Societies or Provincial Agricultural Councils attached to scientific bodies may be appointed to report on rural economy, being subsidized and acting on a scheme laid down by the Institute to include the special study of regional problems; (*d*) the Technical Committee shall have power to assign special enquiries and investigations to individual students who are well-known as experts in the subject.

186. **Celebration of the Eleven Hundredth Anniversary of the University of Pavia (Italy), May 1925.** — In May next will be celebrated the eleven hundredth anniversary of the reorganisation of courses of study in Pavia, as carried out in 825 A. D. by Lothair, King of Italy, who designed the School at Pavia, which still flourishes as the centre of higher education in Lombardy.

187. **Regulation of the Agricultural Services of Tripolitania.** — These services have been reorganised on lines more nearly corresponding to the needs of local conditions and to the beginnings that have been made in bringing under cultivation the fertile steppe zones of the hinterland. The Services are placed under an inspector, who is in charge of (1) the Bureau of Agricultural Propaganda which is responsible for studying and giving effect to the measures designed to improve local agriculture and stock-breeding, also for promoting schemes for assistance and inspection among farmers and stock-breeders, and for popularizing scientific methods of agriculture and stock-breeding, This Bureau also keeps up to date and compiles the agricultural statistical returns; (2) the Agricultural Experiment Institute of Sidi Mestri which is responsible for conducting scientific experiments in technical agriculture, stock-breeding and economic agriculture ; (3) a section of research in agricultural chemistry and insustrial agricultural technology. The Inspector of the Agricultural Services is himself under the Land Settlement Office. (*Ministrero delle colonie. Bollettino di Informazioni economiche* Sept,-Oct. 1924).

188. **The Japanese Libraries destroyed by the Earthquake.** — The University Library of Tokio, which was destroyed by the recent earthquake is being rapidly restored. A large number of books and other publications have been given by the Rockefeller Trust, by the University of Rome, by Germany, Michigan, Colombia and California, as also by French, Dutch, Swiss, Indian and Australian educational institutions.

Dr. FRITZ HABER of Germany, the inventor of a process of fixation of atmospheric nitrogen, has been authorized by this Government to proceed to Japan to present as a gift from Germany to the Japanese Government a collection of scientific books to replace in some measure what has been lost from the Imperial Library.

189. **Polish National Institute of Rural Economy at Pulawy.** — This Institute is placed under the Ministry of Agriculture, though independent as regards its internal management. It is administered by a Scientific Council composed of the heads of the different Sections, and a chairman is elected by the members from among their number.

The Section of Agricultural Chemistry deals with improved scientific and economic methods of applying artificial manures, making experiments for the purpose by field and pot cultivation. The Plant Cultivation Section makes a special study of pure and applied genetics and employs for the purpose a large selection of plants, cereals, forage plants, potatoes and vegetables. The Horticultural Section carriees out researches not only in its own special domain of pomology but also on ornamental plants and on seed production. There is also a Section for Soil Science which is studying the classification of the soils of Poland, and collecting the data required for the construction of a pedological atlas of Poland. A special Section deals with phytopathology and is linked with the Entomological Section.

Considerable development is going on in regard to the zootechnical enquiries which fall under three heads: (*a*) zootechnics properly so-called; (*b*) morphology, physiology and genetics; (*c*) stock feeding and rationing. A Central Biochemical Laboratory enables the Sections which are not provided with Laboratories to study some of their problems from the purely chemical side.

190. **Organisation of Cold Storage in Russia.** — Russia, as a rich country and a producer of perishable goods has been for a long time interested in the cold storage industry, but the organisation of the industry really dates from 1909 the year of the constitution of the first " Cold Storage Committee " attached to the Ministry of Trade and Industry. In 1910 a special Committee was established in connection with the Society of Rural Economy at Moscow, which was later transformed in 1911 into the Special Cold Storage Committee. These two Committees organised branches all over the country, congresses, lectures, and courses of instruction; they took an active part in international congresses and propaganda by means of pamphlets, printed instructions, etc., was actively carried on by their press office.

During the war the Moscow Committee built a refrigerating depot in connection with the transport of meat from east to west, and the Petrograd Committee instituted military cold storages. During the Revolution activity was checked, and the only Committee at work was the Leningrad Committee, which in spite of very difficult financial conditions succeeded in issuing propagandist publications, holding a number of conferences and further in organising two experimental transports to Leningrad, one of fish from the Murman fisheries, and the other of Turkestan sheep, both to Leningrad and Moscow.

In 1920 the functions of the Leningrad Committee were transferred to the Scientific-Technical Council set up in connection with the Central Administration of the refrigerating storehouses and of slaughterhouses, but for want of funds the activity of this body was short-lived But the requirements of the cold storage industry led to the creation, in March 1924, of a Central interdepartmental Committee of Cold Storage, attached to the People's Commissariat of Agriculture, Moscow, and in the following May the original Moscow Committee was reconstituted. The range of action of the Central Committee is very large and includes: drafting of legislative and administrative proposals on questions of the refrigerating industry, propaganda (including courses of instruction, exhibitions, pamphlets, etc), organisation of Congresses and participation in foreign congresses, general organisation of the industry.

Among the members of the Committee are representatives of Government institutions, scientific institutions and co-operative societies, either directly concerned in or connected with the refrigerating industry. The administration consists of five persons, whose appointment is ratified by the Commissariat of Agriculture, which must also approve all the resolutions passed by the Committee. At the present time the President is Engineer O. O. DREYER and the Vice-President Professor A. W. RIAZANTZEFF. On the occasion of the IVth International Cold Storage Congress, held in London on 16-21 June 1924, the Russian monthly review *Journal of the Cold Storage and Slaughterhouse*

Industries issued a special number intended to provide an up to date account of the situation of the industry in Russia. The articles of this number cover all the aspects of this question, and are as follows : S. ESTRINE, The Immediate Future of the Cold Storage Industry in the U. S. S. R. and its Immense Possibilities ; A. W. RIAZANTZEFF, the Construction of Refrigerating Stores and of Government Slaughterhouses ; S. PODERNY and TIHOTSKY, The Construction of Municipal Refrigerating Stores ; C. DREYER, The Transport on the Russian Railroads of perishable Goods ; P. DENISSOFF, The organisation and Inspection in Russia of the Transport of Perishable Goods ; H. TOULOUNINE, The Refrigerating Stores and the Government Slaughterhouses since 1920 ; F. KOCH, The Sanitary Inspection of Perishable Goods in the Government Refrigerating Stores ; E. KARATYGUINE, Russian Cold Storage Organisations and their Work ; The Central Committee attached to the Commissariat of Agriculture and its Activity. (*Bull. mens. des Renseignements frigorifiques*, Year 5, No. 7, 1924).

Conferences and Congresses.

191. **VII International Congress of Olive-Growers, Seville. December 5-19, 1924.** — This Congress succeeded that held at Nice from 14-20 October, 1923, the resolutions of which were published in this Review in the same year (*International Review of the Science and Practice of Agriculture* No. 4, p. 1138 ; 1923). The following countries were officially represented : Algeria, Argentina Chile, Egypt, France, Greece, Italy, French Morocco, Mexico, Peru, Portugal, Spain, Tunis, Uruguay ; also important associations for olive-oil production, manufacturers, farming and trading societies ; the International Institute of Agriculture was represented at the Congress by the Spanish Delegate, a member of its Permanent Committee.

Work of the Congress. — The reports presented will be published in full in the Official Report, which will appear in Spanish and French. The titles of the works and the principal resolutions passed at the end of each debate are given below.

Section 1 : *Olive Growing* — D I E. PRIEGO y IARAMILLO and D. J. CRUZ LAPAZARÁN (Ing. Ag.) : Varieties of the olive, its classification, practical deductions ; — D J. MIRANDA and D. F DE LA PUERTA (Ing. Ag.) : Olive Growing, — D. J. AGUILLÓ and G. G. QUINTANILLA (Ing. Ag) : Methods of Fertilising and Disinfecting Soils ; — D. F. ULLASTRES and D. A. CANDAU (Ing. Ag.) : Harvesting, Transport and Preservation of the Olive.

Section 2. — D P. DE SOLIS (Olive grower and, oil-producer) and D. A. CRUZ VALERO (Ing. Ag) : Methods of Preparing Olive Oil ; — D. M. VELASCO DE PANDO (Industrial engineer and constructor of oil-production machinery) : Utilisation of the Residues ; — D. J. J DE OLMEDO and D. P. GUTIÉREZ CALDERÓN (representing the " Asociación de Exportadores de aceitunas sevillanas ") : Methods for Preserving the Olive.

Section 3 : *Olive Oil Production Trade.* — D. J. CACHOT (representing the " Sindicato de Exportadores de aceite de oliva de Urgel y Campo de Tarragona ") : Trade in Olive Products ; — F. BILBAO y SEVILLA and D. M. DE SOROA (Ing. Ag.) : Statistics of Production, Consumption, Importation and Exportation to various countries ; — D. J. CÁNOVAS DEL CASTILLO (General Secretary of the " Asociación de Agricultores de España) and D. L. PALLARES (Producer and exporter of olive-oil) : Trade Marks and certificates of Origin.

Section 4 : Diseases of the Olive. — D. L. NAVARRO, D. I. V. CLARIO and D. J. NONELL y COMAS (Ing. Ag.): The more important Olive Pests and Methods of Prevention and Control.

Section 5 : Hygiene and Nutritive Properties of Olive Oil. — D C FERNÁNDEZ (Chief of the Department of Chemistry of the " Instituto Nacional de Hygiene de Alfonso XIII ") : Hygienic and Alimentary Properties of Olive-Oil ; — D. PETTERS (Chemist) and D J. AGUILÓ (Ing. Ag) Refining, Purification and Mixing ; — D. G. QUINTANILLA and D. I. DIAZ MUNOZ (Ing. Ag.) : Analytical Methods for determining Quality, Adulteration and Imitations.

Section 6. International Olive Oil Production Associations. — D. A. AGUIAR y GOMEZ ACEBO (Member of the Committee of National Economy) : Organizations, National, International, and those which may be formed in olive-oil producing countries, for promoting the increase of oil production. Mutual relations among the Associations themselves, of a private, official or social character, with a view to facilitating the sale of olive oil and its products.

Resolutions of International Importance. — In all, 98 resolutions were passed by the six sections but only those are given which refer especially to international activity and with which the present *Review* is also concerned ; other resolutions relating to agricultural statistics are reported in the *International Crop Report and Agricultural Statistics*, No 1, 1925

Section 1, in the 4th resolution concerning the first report on the classification of olive varieties, approves of the formation of central commissions, in regular communication with the District Agricultural Institutes, for the examination of these varieties and which would report to the International Institute of Agriculture on the work done, which will undertake the compilation and publication of these reports.

As regards olive cultivation, in view of the exceptional importance to the world's economy at the present time of increasing the area of olive plantations in order to meet the increased demand for exportation and home consumption, hopes were expressed that new olive plantations will be encouraged and subsidised, and that Governments and Agricultural societies will assist and encourage intensified olive-growing in the present zones of production.

Concerning the utilisation of olive residues (section 2) a resolution was passed that the Governments and Societies interested should encourage research and improvement in the methods and treatments of the residues and that information respecting residues should be published.

In section 3, in the sixth resolution regarding trade marks and certificates of origin, it was agreed that these might be useful and even necessary, but that no fixed rule should be made in this respect in order not to interfere with unrestricted trading.

In section 4, after having considered the principal olive pests found in the Mediterranean basin, and the most practical measures for their control, it was resolved (8 and 9) to carry on further research work with a view to discovering effective solutions for the control of *Gloeosporium olivarum* and *Macrophoma dalmatica*, and (resolution 11) in order to assist investigations regarding the natural or biological campaign against olive diseases and pests, it is considered necessary that all the centres of agricultural research or similar institutions should classify the parasites existing in their respective regions and publish the results obtained.

In section 5 it is resolved provisionally, until the Commission appointed for this purpose decide definitely, that the trade samples of olive oil must conform to the following requirements : coefficient of refraction from 1.4663 to 1.4681 ; coefficient of saponification from 181 to 215 ; iodine coefficient from 74 to 93.

Finally, in section 6, it is resolved to " establish an international organisation which will group the National Oil-Production Associations into a Federation, the object of the organisation being to deal with questions of a technical nature and with propaganda At the same time, in the various countries, National Associations should be formed which in due course will become an integral part of the International Federation. The documentation will be carried out at the International Institute of Agriculture at Rome, and in the next Congress the seat of the Federation will be decided, in the meantime it is proposed that it be at Seville "

Meetings — Papers were read by : Messrs V DORE (Head of the Statistical Department of the International Institute of Agriculture) on the work of the International Institute of Agriculture ; D G QUINTANILLA (of the *Estación agronómica Central*) on the extraction of olive-oil by the « Acapulco » process, of which he is one of the inventors ; D R MANJARRES, on the utilisation of olive residues ; D L SAEZ, on the influence of potash in olive-production. Other meetings, which required the aid of cinematographic films or lantern slides, were held by the ex-Director of the *Estación Central de Patologia Vegetal*, D L NAVARRO, on diseases of the olive ; D J MIRANDA, on the olive plantations on the banks of the Douro , Sr SALVATELLA on olive oil-production machines , D J GAVILÁN on the nitrate industry in Chile

Publications — Among the publications of a technical nature distributed among those attending the Congress were " Summary of the data on olive-oil-production in Spain ", prepared by the *Consejo Agronómico Nacional*, " Methods for Analysis of the Olive and Residues of the Olive-oil-Production Industry ", edited by D G QUINTANILLA (Ing Ag) and D J DIAZ y MUNOZ of the *Estación Agronómica Central* , a leaflet on the Varieties of the Olive, with numerous illustrations, edited by D A FERNNÁDEZ, of the *Servicio Agronómico de Sevilla* , Bulletins of the *Estación olivarera de Tortosa*, etc.

International Competition of Essays — Numerous specialists from many countries sent works on the subjects of which notice has already been given in the last number of this Review A special Commission was charged with the examination of these works, but in view of their varied nature, rendering laboratory work necessary in order to judge of the efficiency of some of the methods proposed, the decision of the Commission will not be made known until the necessary tests have been carried out by the Professors of the *Escuela Especial de Ingenieros agronómos* specially appointed for that purpose ; the prize essays will be inserted in the " Book of the Congress ", which will form a valuable treatise on the technique of olive-growing and oil production.

Olive-oil production Laboratory. — For the first time in such International Congresses, a laboratory was establised with the object of analysing olives, olive-oils and residues of the olive-oil production industry. The *Estación Agronómica Central* is under the direction of Prof DIAZ MUNOZ (Eng. of the *Estación Agronómica Central*), assisted by Messrs A VIRGILI, QUINTANILLA (Jnr) and MONTERO. Hundreds of analyses were made at the request of the public and of those attending the Congress.

Excursions to Olive Plantations and Mills at Seville and Toledo. — With a view to instruction and obtaining information on this subject various excursions were made and the following farms were visited: " Castillejo de Talhara " — " Lugar Nuevo " — " Casaluenga " — " La Plata " — the establishment of the " Union Olivarera " at Carmona, the property of Marquis ACAPULA, where an opportunity was given to observe the method of extracting olive-oil invented by the proprietor and named after him. At Jaen the Members of the Congress were able to examine the measures taken by the local *Sección Agronómica* and *Cámara Agrícola* against the attacks of *Phloeothrips oleae* on olives. The modern plants at Velez-Malaga, Puente Genil and the superb oil-mill of Valderrama at Montilla were also visited. These excursions were made to Andalusian farms to observe the methods of olive-pruning, cultivation, etc, and to see olive-oil producing establishments Excursions were also made to Toledo and Mora de Toledo

Spanish Olive-Oil Production Exhibition — This Exhibition was opened on the 6th December on what will be the premises of the next Spanish-American Exhibition, in the Parque de Maria Luisa at Seville, where the exhibition of important trading firms and Agricultural Societies were shown In two salons the *Servicios Agronómicos* exhibited specimens, photographs, graphs, etc, arranged according to the province, and thus forming a National Museum of Olive Growing and Olive Oil Production

Next International Congress on Olive-Cultivation — In the closing session it was resolved that Rome should be the seat of the next Congress, which will take place in the Spring of 1926

192 **The International Cattle Breeding Congress held at the Hague, August-September, 1923.** — The report has just been published, of the important International Cattle Breeding Congress held at the Hague in September, 1923, in order to bring together prominent people connected with cattle breeding, in order to assist an exchange of ideas and the compilation of interesting literature on the subject

The Congress was divided into four sections, each of which took two subjects for discussion

Section I : Heredity and Feeding.

(*a*) What new information is available regarding the doctrine of heredity which should be considered as important in cattle-breeding ?

(*b*) The new points of view regarding feeding.

Section II : Registration.

(*a*) What particulars should be entered in the genealogical registers and in what way should this information be controlled to ensure the maximum accuracy ?

(*b*) How can milk production be regulated and is it possible to establish international regulations ?

Section III : The Intervention of the Authorities and the Work of the Associations.

(*a*) How can the authorities encourage cattle-breeding other than by veterinary measures ?

(*b*) In what way can the associations for the improvement of cattle derive practical advantage from the information furnished by science and registration ?

Section IV : Economics

(*a*) What qualities should cattle possess in order to satisfy definite professional requirements ?

(*b*) How can the control of tuberculosis in cattle be carried out in practice and what are the results of experience on this question in the various countries ?

The first part of the Report contains an account of the discussions in the sections, based on the reports previously sent to the Organising Committee of the Congress, of which the President of the Sections gives a brief review at the opening of the meeting, while those submitting the reports give useful supplementary information

In the second part of the Report are published, *in extenso*, the reports presented to the Congress by numerous scientific authorities These reports are published in the language in which they were drawn up and are sometime accompanied by a summary in French, English and German

Especially deserving of mention is the important part taken in the work of this Congress by the International Institute, represented by M Fjelstad, Norwegian Delegate to the Permanent Committee M Fjelstad described the activities of the Institute in reference to cattle-breeding and allied questions. His report led the President of Section II (*b*)to express the following wish, which was adopted as a resolution " The International Cattle-Breeding Congress, held at The Hague in August, 1923, while appreciating the work already done by the International Institute of Agriculture, and in consideration of the practical results achieved in the statistical and commercial domains of animal products, the regulation of milk-production and cattle-breeding, requests the Institute to continue and still further develop its work in the above-mentioned spheres "

Section IV (*b*), dealing with the important question of bovine tuberculosis, passed the following resolutions

1 In the interests of economy and hygiene, measures against bovine tuberculosis are urgently needed

2 These measures shall be based on the initiative of the breeders interested ; the State will undertake to place at the disposal of the breeders all useful information on the nature of the disease and the prophylactic measures for its suppression.

3. The chief object of these measures will be to obtain cattle stock rendered immune by protection from all infection during breeding.

4. The State will encourage by means of grants, the formation of healthy stock to replace an infected herd.

5. Administrative measures will be taken with a view to the destruction of excrement, and the pasteurisation of skimmed milk and milk by-products.

6. The public authorities will take measures against the spread of tuberculosis, when observed on the farms of breeders who, voluntarily, adopt preventive measures.

7. The taking of action to set aside sales owing to the existence of bovine tuberculosis, is to be recommended.

The following resolution was passed in the closing session of the Congress :

" The Congress is of opinion that the relations established during the Congress among members should not cease with the closing of the Congress. To prevent this, it is proposed that each country appoint a correspondent or give an address, and that the Central Office remain temporarily situated in Holland.

" Proposals regarding a new Congress to be held in another Country should be addressed to this Office ".

M. Massé, President of Section IV*a*, and M. Fjelstadt recalled the work of the International Institute of Agriculture in this connection, and it was agreed that the new Office should work in close collaboration with the Institute. (*Report of the Proceedings of the International Cattle-Breeding Congress organised under the high patronage of H. M. the Queen of Holland at the Kurhaus at Scheveningen near The Hague, from 22 August to 4 September*, 1923.

193. **Belgium : International Conference on Tropical Rubber Products and allied Industries. Brussels, 1-16 April 1924.** — The Official Report of this Conference has been published and can be obtained from the " Rubber Growers' Association ", 2-4 Idol-lane, London, E. C., price 5s 6d. post free. The discussions turned on questions of the production of raw rubber rather than on technical and industrial points. Well known experts made important communications on the principal problems. (*The Rubber Age* Vol. V, No. 7, London, 1924).

During the exhibition the Brazilian Government, represented by the High Commissioners, MM. HANNIBAL PORTO and J. A. BARBOZA CARNEIRO, arranged for the publication of a daily report printed on good paper and with numerous illustrations and statistics, giving the various aspects of the economic wealth of Brazil, the agricultural resources, the stock-breeding, mineral wealth, etc. and some illustrations of the intellectual movement in the country. There are 17 numbers, covering 200 octavo pages in all and each one may be said to be complete in itself as regards the subject treated.

194. **Peru : Pan-American Conference on Standardization, Lima. December 1924.** — This conference was called by the Pan-American Union at the request of the Fifth International Conference of American States which met at Santiago, Chile, in 1923. The Peruvian Government sent invitations to the twenty-one republics of the Pan-American Union and to a number of technical and commercial associations, both Peruvian and others. The general purpose of this conference was to study the possibilities of developing inter-American and international standards for raw and finished materials as well as standardized classifications and nomenclature and to make recommendations with regard to a gradual policy that might be adopted by governments interested in these important questions.

In drawing up the programme of this conference the Peruvian Government utilized the co-operation of the Pan-American Union and Inter-American High

Commission and these in turn obtained the advice of representative organisations and individuals. The preparatory work on questions relating to agricultural products, both raw or manufactured was handled by the U. S. Departments of Commerce and Agriculture. The American Engineering Standards Committee undertook preparatory work among the manufactures of North America, and an advisory Committee has been set up on the request of ROWE, the Director General of the Pan-American Union. (*Science*, Vol. LX, No. 1560, 1924).

195. **Hawaii : First International Conference of Sugar Planters and Manufacturers, Honolulu, 26 July to 14 August 1924.** — In the *Louisiana Planter and Sugar Manufacturer*, New Orleans (LXXIII : No 7, 1924), there appear notes on the work of the Conference on methods of cultivation, on varieties of cane-sugar, on the sugar industry in Australia and Fiji, on technical problems related to the industry, etc.

196 **First Pan-Pacific Food Conservation Conference, Honolulu, 31 July-14 August 1924.** -- This Conference met under the chairmanship of Dr. L. O. HOWARD, Chief of the Bureau of Entomology of the United States Department of Agriculture There were present 95 delegates : 38 from the mainland of the United States, 55 from other Pacific countries and two from the West Indies Twelve duly appointed delegates from Hawaii and 36 residents took part in the meetings which were also attended by a number of other local persons Altogether fourteen Pacific countries were represented by about a hundred and forty technicians of both sexes

The Conference which was the fifth of the series designed to promote a mutual understanding by peoples of the countries round the Pacific, of the different common problems was, summoned by and held under the auspices of the Pan-Pacific Union It was organised in seven sections, the most important of which were devoted to (*a*) the sugar-cane industry, (*b*) fisheries, marine biology and oceanography, (*c*) plant protection through quarantine and researches in entomology and phytopathology and (*d*) food-crop production and improvement. As a result of the discussions in the sugar-cane industry section, there was tentatively organised an international association of persons interested in the industry, and it is hoped that this association will meet at Havana in 1927

At the final sessions thirty-three resolutions were adopted . three of these relate to the sugar industry, six to fisheries, four to plant protection, one to animal industry, four to food-crops, three to marketing problems while the rest are of a more general nature

Classifying the resolutions on a different basis, three refer to the work of the Pan-Pacific Science Congress to be held in Japan in the autumn of 1926, six to the protection of food resources by international treaties and agreements and twelve recommend more or less specific programmes for future research.

A Committee appointed for the purpose will publish a full report of the proceedings of this important Congress (*Science*, N. S., Vol LX, No. 1549, 1924).

197 **France : International Dairy Congress, Paris, 1925.** — This Conference will be confined to dairy questions in relation to hygiene and food values, dealing with fresh milk, sterilized and pasteurized milk, the organoleptic qualities of milk, etc. The dairy produce industries, such as cheese-

making are not to be included. Application will be made at the Congress for the ratification of the scheme already drawn up by the permanent Bureau of the International Dairy Federation for the establishment of an International Milk Bureau at Brussels, and the adoption of a resolution to safeguard the designations of origin of milk products on the world market will be required.

198. **Belgium : International Congress on Technical Instruction. Charleroi, April 1925.** — This Conference is to be organized at the Charleroi " Université du travail " by the Committee for the improvement of industrial and agricultural education, and will include a Section for technical agricultural instruction Special arrangements are being made to enable specialists of all nationalities to form an idea of the completely modern organisation and the special character, both scientific and technical and vocational of the institutions of the province of Hainault, while at the same time giving them an opportunity of judging of the application to practice of the demonstration courses given by the teaching staff and well-known agriculturists, former students of the different institutions Visits will be made to the establishments, and it will be possible to attend the demonstrations, and in addition reports will be presented to the Congress Enquiries should be addressed to : M. R. LUQUESNE, Secretary of the *Executive Committee* 45, Rue du Hautbois, Mons Belgium

199, **Canada : Third World Poultry Congress and Exhibition. 1927.** — In May 1924 the *International Association of Poultry Instructors and Investigators* received permission from the Government of Canada, through the Canadian Minister of Agriculture, with the support of the Ontario Minister of Agriculture, the Canadian Pacific Railway, the Canadian National Railways and representatives of the United States of North America, to hold the third World Poultry Congress on Canadian soil, in 1927 Full facilities are guaranteed by the Dominion Government for delegates and visitors to the Congress and in particular to the poultry show to be held at the same time

After due consideration of the question by the Council of the International Poultry Association, which inaugurated this type of Congress and in view of the fact that the first and second Congress were both held in Europe, namely in Holland in 1921 and in Spain in 1924, it was resolved that the third should be held in North America The invitation of the Canadian Government was consequently accepted, and the more readily, since more than 50 % of the members of the International Association, all either engaged in giving instruction or in investigating poultry questions or in some special work on the subject, are living either in Canada or in the United States In these countries too there has been greater progress in the various branches of poultry-keeping in the last twenty years than elsewhere. Hence all persons who take part in the Congress of 1927 will have the opportunity of visiting the North American Universities and Colleges, in which the fullest instruction is given in this branch of food production, of meeting the most celebrated professors and investigators, of observing the methods adopted on a large scale by producers and of studying the systems in use for the marketing of eggs and poultry. This Congress will be held under conditions peculiarly favourable from the educational standpoint. The arrangements for the conduct of the Congress will be published in due course and formal invitations to attend will be sent to the

Ministries or Departments of Agriculture of the different countries. In the meantime communications or enquiries may be addressed to Mr. Edward Brown, F. L. S. President of the *International Association of Poultry Instructors and Investigators*, 20-21 Essex Street, London, W. C. The date of the Congress will be announced within the next few months.

200. **Poland: International Congress of Agriculture, Warsaw, 21-24 June 1925.** — Five Sections will be included: (1) Rural Economy; (2) Vegetable Production; (3) Animal Production; (4) Agricultural Industries; (5) Scientific Section, agricultural experiments, agricultural instruction. The subscription is fixed at 10 *Zloty* (50 French francs).

201. **German Colonial Congress, Berlin, 17-18 September 1924.** — The German review of tropical agriculture, *Der Tropenpflanzen*, has issued a special number (Year XXVII, No. 4, 1924) relating to this Congress, containing the following important articles: M. Busse, Agriculture in the occupied German Colonies, A. Zimmermann, Retrospective Survey of the Work of the Institute of Agricultural Biology at Haman; Geo A. Schmidt, Agriculture in Mexico, W. A. Th. Muller Neuhaus, Transport in the Tropical Regions Unprovided with Railways, O. Prense, The Biology of the Coconut Palm; Fr. Tobler, The Preparation of Tropical Textile Fibres, W. Rushmann, Cultivation of the Tomato in Teneriffe and the Canary Islands

202 **Brazil: Congress of the Municipalities of the State of Rio de Janeiro.** — From the point of view of rural economy and scientific agriculture the following papers read at this Congress by M. Alvano Paes, prefect of Itaguahy are of considerable interest: (*a*) Poultry-breeding in the State of Rio; (*b*) The protection of the agricultural labourer as a factor in reduction of the cost of living, (*c*) the Co-operation of the Municipalities in the work of Rural Sanitation: (*d*) The establishment of Sanitary Engineering bodies as a means of maintaining healthy conditions in the rural districts, (*e*) Cotton growing in the State of Rio, (*f*) Reforms in Primary Education In the *Brazil Ferro-Carril*, Year XV, Vol XXVII, Nos. 365, 373, 1924, the resolutions passed in the different Sections of the Congress, and also those of Section II, Agriculture and Stock-breeding and Rural Economy were published in extenso (*Brazil Ferro-Carril*, Year XV, Vol. XXVII, Nos. 365, 367, 368, 369, 373, 1924).

203. **United States: Proceedings of the Fifty-Sixth Convention of Farmers and Fruitgrowers at Santa Ana, California.** — Important questions were under discussion at this meeting which was held on 6-7 December 1923, under the auspices of the California Department of Agriculture. The subjects relating both to the scientific and the practical side of agriculture, included reports on the quarantining of plants, intended to prevent the introduction of vegetable pests and infection into the United States, reports on immigration and agricultural labour, the problem of transport and market conditions. The Proceedings of the Fifty-Sixth Convention of Fruitgrowers and Farmers, Santa Ana, California, have appeared in a volume of 148 pages, forming Nos. 1 to 6 of Vol. XIII of the Monthly Bulletin of the Department of Agriculture, State of California, published at Sacramento, California, June 1924.

204. **Annual Meeting of the Metric Association. Washington D. C., 29-30 December 1924.** — At this meeting of the *Metric Association*, lectures were given by experts in reference to the work of the Association,

and an exhibition was held and demonstrations given of modern methods of instruction in the metric system of weights and measures. Information may be obtained prom the Metric Association, New York City.

205. **National Conference on the Utilization of Forest Products, Washington, 19-20 November 1924.** — This Conference was called by Dr. WALLACE, the Secretary of the Department of Agriculture, United States, for the discussion of the following questions: (1) the determination of the nature and extent of the present preventable wastes, in forest production, how far prevention is attainable in view of the results of research, how far better utilization is retarded not only by economic conditions, but by failure to apply available technical knowledge; (2) the nature and extent of the present unpreventable wastes, and how an enlarged programme of research may lead to improved methods of prevention ; (3) the consideration of policies and measures which might be supported by industrial, professional and governmental agencies, so as to insure the most efficient development and use of the forest resources of the United States; (4) the formation of a permanent advisory committee on the utilization of forest products. (*Science*, N. S , Vol. LX, No. 1555, 1923).

206. **France : Thirty-first Congress of the Milling Industry. Paris, October 1924.** — The chief questions proposed for discussion were as follows : The production of wheat in France in 1924, in relation to the working capacity of the mills, and the needs of the community ; the extraction percentage of the flour and the regulations there contained in the Decree of 21 August 1924, which fixes a minimum extraction rate of 78 % ; the introduction of substitutes into wheat-flour; the taxation of the products of milling and the effects of the law from the point of view of commercial transactions ; the acceptance of foreign grain at the French ports ; the determination of their specific weight at the time of unloading the cargo, by means of the 20 litre and the Schopper balance ; the drafting of a French importation contract and the establishment of an arbitration office . the Chemistry Department of the Milling Industry.

The French Shool of Milling will be opened at the same date as the Congress. Enquiries may be addressed to the Secrétariat Général de l'Association Nationale de la Meunerie Française ; Place du Louvre 6, Paris.

207. **Italy : Viticultural and Wine-making Congress. Casale Monferrato, 7-5 September 1924.** — Reports presented to the Congress : Professor PIROVANO, New prospects in viticultural genetics ; Professor CABOTTO, Causes of withering in grafted vines; Professor ZAVATTANO, Viticultural Conditions of the Province of Alessandria ; Professor PERSI, American Piedmontese Hybrids. There was also a report by Cav. MARINI — on fiscal charges on wine, — and of Sig. MARESCALCHI — on questions relating to wine-making (instruction, manufacture on a large scale, transport, distillation, credit, distribution of wine to the army and navy, export trade).

Exhibitions, Fairs and Competitions.

208. **Belgium : XXVIIIth Grand International Poultry Exhibition, Brussels 24-26 January 1925.** — Enquiries to be addressed to M. B. Boty, Secrétaire Général, 95, Avenue Royler, Brussels.

209. **Spain: International Sample Fair. Barcelona, Spring 1925.**

210. **France: International Poultry and Bee-Keeping Exhibition Lyons, 7-11 January 1925.**

211. **New Zealand: International and South Seas Exhibition. Dunedin, November 1925.** — Announced in the *South African Journal of Industries*, Pretoria (Vol. VII, No. 8, 1924) as financially supported by the New Zealand Government.

212. **Switzerland: Colonial and Exotic Products International Fair. Lausanne, 27 June to 12 July 1925.** — Under the patronage of the Swiss Government. Among the sections are: (*a*) Food Products of agriculture and fishing; (*b*) Other products of agriculture and fishing; (*c*) Horticultural produce, (*d*) Forest products and industries; (*e*) Mineral products; (*f*) Colonial arts and manufactures.

213. **Uruguay: International Sheep Show, Montevideo, February 1924.** — The Show was held under the auspices of the *Uruguay Rural Association* Sales of animals of choice breeds were effected and the prices paid for two rams were respectively 400 and 750 pesos.

214 **Austria: Alpine Agricultural Fair. Innsbruck, Tyrol, 5-12 October 1924.** — Although mainly of an agricultural character, all rural industries were here represented The main groups were: agricultural stock-breeding, a show of cheeses, fruit-growing and gardening, bee-keeping, agricultural instruction

215 **Belgium: Exhibition of Farm Machines and Products and Great Agricultural Week, Brussels, 14-22 February 1925.** — Organized by the Society of Farm Mechanics and Agricultural Industries, and under the patronage of the Belgian Ministry of Agriculture. The programme includes: farm machinery properly so-called, machines for cultivation, methods of cultivation and preparation of the products, milking machines and dairy apparatus various types of apparatus for preventing accidents with farm machines; home colonization exhibits, plant for land improvement, land drainage, irrigation, levelling, clearing, etc, forestry plant; fishing, poultry-keeping and beekeeping equipment horticultural exhibits; greenhouses, heating apparatus etc, machinery and implements for agricultural industries; steam, petrol, wind, electric hydraulic power machines and motorcultivators; lorries, tractors, etc.; materials for rural buildings, and equipment; tools and implements; farrier's instruments, harness, fertilizers, stock feeds, dips; instruction and diagrams relating to farm machinery; rural electric and mechanical plants. Enquiries may be addressed to M A CARLIER, Secrétaire de la Société de mécanique et d'industrie agricoles, 29, Rue de Spa, Brussels.

216. **Brazil: Pernambuco Municipal General Exhibition. October 1924.** — A Bee-keeping Section showed the progress made in Pernambuco as regards the production of honey and wax, and improved methods of collection (*Brazil Ferro-Carril*, Year XV, Vol. XXXVII, No. 372).

217. **Agricultural and Pastoral Exhibition at Jaguarão, Rio Grande do Sul.** — Opened on 29 November 1924 by the local Agricultural and Pastoral Society (*Sociedade Agricola e Pastoril*). A number of Uruguay breeders took part (*Brazil Ferro-Carril*, Year XV, Vol. XXVII, No. 372).

218. **France: National Seeds Fair, Versailles, 17-25 January 1925.** — Under the patronage of the Ministry of Agricilture, and inaugurated by the Federation of the Agricultural Associations of the Seine, under the auspices of the Offices Agricoles of the North and of the Department of Seine.

219. **China: French Indo-Chinese Fair, Hanoi, 30 November-14 December, 1924.**

220. **Great Britain: Textile Fibres at the British Empire Exhibition, Wembley.** — In the Manchester *Journal of the Textile Institutes* (Vol. 15, No. 9, Manchester, 1924), an account appears of the Wembley exhibit of the production of textile plants in the British colonies, including cotton, sisal, flax, hemp, Manilla hemp and other fibres of minor importance from the following territories, Sudan, Nyasaland, Tanganyika, Uganda, Kenya, Zanzibar, Mauritius, and the Union of South Africa. Information on the cultivation of these fibres in the different countries is also given

221. **Gold Coast. Colonial Exhibition, March-April 1925.** — The object of this exhibition is to encourage trade between England and the territories of West Africa and to afford representatives of the manufacturers the opportunity of studying the needs of the various populations on the spot. The Exhibition will include five main sections: trade, agriculture, cultivation of orchard trees, mineralogy, arts and crafts. The products of the four colonies of British West Africa, viz., Nigeria, Gold Coast, Gambia and Sierra Leone will be shown, and the mineral exhibits of these regions will illustrate the important part taken by the mining industry in the economic development of the Gold Coast in the last 30 years. In the Arts and Crafts Section the artisans of the four colonies above-named are grouped together in one pavilion and carry on work in common.

222. **Italy: The Horticultural Conferences of the Royal Tuscan Society of Horticulture, Florence, 18 January, 15 February, 15March, 19 April 1925.** — All persons taking part in these meetings have the opportunity of showing any kind of horticultural produce (plants, flowers, fruit,vegetables) which they consider worth bringing to the notice of those attending the conferences

223 **Stock Competitions at the Milan Fair April 1925.** — In the Stock show at this fair breeds of cattle will be exhibited which have not been shown at previous fairs, including the Chianina breed, the pure-bred Polodica, the Tarin or Savoyard, the Danish. A large number of Belgian horses will also be shown.

224 **Northern Ireland: Exhibition of Flax; Lambeg, Belfast, 16 October 1924.** — This exhibition was held in connection with the experimental Laboratories of the Linen Industry Research Association. Various subjects relating to the textile plant in question were treated with demonstrations by the staff of the laboratories such as the flax stalk, the constituents of the plant, pests, etc damaging the seeds, etc. A demonstration of the valuable work carried on by the Experimental Institute of the Association was given. (*Journal of Textile Institutes*, Vol. XV, No 11, pp 581-582. Manchester, 1924)

225. **Switzerland: Swiss Sample Fair,** Bâle, 18-28 April 1925.

Development of Agriculture in the Different Countries.

226. **Brazil: Agricultural Development in Brazil.** — A number of questions relating to scientific agriculture in Brazil in the three years 1921-1923 are handled in a series of chapters, supplying much statistical and other information, by M. HANNIBAL PORTO, deputy to the Rio de Janeiro Council and member of the Brazilian Higher Council of Industry and Commerce. In addition to some subjects which are also af international interest, such as cotton and rice growing, the production of cacao, timber for building, animal food products, the author deals with various special questions of great importance to Brazil.

For example, a separate chapter is given to each of the following: a valuable substitute for rubber, obtained from balata, the coagulated latex of *Mimusops bidentata* D C an indigenous *sapotacea* of Guiana and of the Northern Amazon locally known by the not very precise name of "massarandubas"; the vegetable ivory, obtained from *Phytelephas macrocarpa*, the "Jarina" or "Yarina" of the natives, the "guarana" or "Varana" a *sapindacea* known scientifically as *Paullinia Cupana-Hunth* the seeds of which have a high reputation as a nerve tonic, the "Brazil nut" variety "sapucaia" or *Bertholletia excelsa*, the export of which has rapidly increased while that of the Amazon rubber has diminished, the "babassu" palm the oil of which is the object of an important industry in the States of Maranhão and Piauhy.

Each chapter of the book contains statistics which, taken together, present a complete picture of the great natural wealth of Brazil and thus provide an exhaustive economic survey (HANNIBAL PORTO Aspectos economicos do Brazil Retrospecto de 1921 e 1923 Considerações sobre nossas possibilidades mercantis pp 303, 8vo Rio de Janeiro, 1924)

227 **Colombia: National Reserves for Agriculture.** — In March 1924 the Government of Colombia issued an order by which the public lands in the banana zone of the Department of the Magdalena were declared national reserves to be used for the cultivation of certain products A commission was also appointed to survey, map, and mark the boundary of these Government lands. (*Bulletin of the Pan-American Union*, p 720, 1924)

228. **Cochin-China: Rubber Plantations.** — According to the *Comptes Rendus de l'Académie des Sciences Coloniales*, 1924, the plantations may be classified in three groups. (1) the medium sized plantations of small Government employees, or of persons employed in trade or industry, taken up as a lucky speculation on denuded lands, in the more healthy parts in the neighbourhood of native settlements This example has been followed by a few of the inhabitants of Annam, (2) the companies installed in the Bien-Haa region, in the neighbourhood of the railways, on the red earth lands partly disafforested and infested by the "Imperata" grass which makes special methods of clearing the soil necessary. Mechanical methods of cultivation have been applied on the *Suzeenah* plantations and An-Loc, where health camps have been organized in a markedly malarial centre; (3) companies formed in 1910 and afterwards, including the "*Société des Caoutchoucs de l'Indochine*". In the laying out of these plantations Malayan methods are usually followed which are in the main those employed by the Mois for their rice plantations in the forests. The vast extent

of bamboo in the province of Thudamot facilitates the application of these methods which are of great importance for the rapid exploitation of large areas of plantation. The latter undertakings have benefited by the experiments made at Xa-Trach on lands covered with light bamboo.

Cochin-China has a very deep soil, and a dry season follows on a period of abundant and well-distributed rains and hence conditions are very favourable to the cultivation of *hevea*. In addition Cochin-China has the advantage of an exceptional supply of labour and it has proved possible to train expert assistance both for the work of clearing, and for establishing plantations and their after cultivation. (*C. R. de l'Acad de Sc. Coloniales*, 1924, quoted in the *Revue Scientifique*, Year 62, No. 18, 1924).

229. **Italy: Italian Agriculture.** — The proposal of the American agricultural review " World Agriculture " for the publication of a number devoted to agricultural Italy and intended to make better known overseas the characteristics, the progress and the future possibilities of Italian Agriculture was supported by S. E. A. SERPIERI, Ex-Secretary of State for Agriculture. The articles intended for the American review were also published in an Italian edition of " Italia agricola ", a review edited by the *Federazione dei Consorzi agrari* which set apart for this purpose the number of October 1924. Hence this issue contains a large number of articles of a comprehensive nature dealing respectively with the following subjects : a sketch of the progress achieved in Italian agriculture (A SERPIERI) ; the rural population (F. COLETTI) , Italian lands (U. PRATOLONGO) ; characterstics of Italian agricultural economics (G. RASSINARI) ; the new Italian agrarian legislation (R TRIFONE) ; agricultural instruction and experiment (V ALPE) ; Italian agricultural co-operation (E. MORANDI) ; land improvement schemes (V. PEGLION) ; Special orchard cultivation (G. BRIGANTI) ; cereal cultivation (E AZIMONTI) ; industrial herbaceous crops (F. ZAGO) ; stock-breeding (N. FOTTICCHIA) , woods and meadows (M. DE BENEDICTIS). The journal is abundantly illustrated (*L'Italia Agricola*, Year 61, No. 10, 1924).

230. **Agricultural Production in Italy.** — The Hon. GIOVANNI RANIERI in a speech made in the Senate on 18 December 1924 gave an account of the grain crop and the live stock production, forestry policy, land improvements or reclamation, irrigation, chemical fertilisers, especially the nitrogenous fertilisers, and in connection with the latter called attention to the wide diffusion of the CASALE and FAUSER processes of nitrogen fixation. Other questions dealing with the increase in agricultural production are discussed in a small 16mo. volume, pp. 29, Rome. 1925.

231. **Panama: Land Settlement.** — A company which has bought 25,000 hectares of land in El Volcan, Province of Chiriqui, is engaged in subdividing and colonizing a large tract of land of which twenty-three 100-hectare lots have already been sold to colonists from California. The chief crops to be raised are coffee, sugar cane, bananas, and other fruit products. It is hoped that the Government will soon begin construction on the road from La Concepción to El Volcan, where the climate, the richness of the region, the building of a hydroelectric plant etc. will all contribute to the making of a thriving community. (*Bulletin of the Pan-American Union*, p. 725, 1924).

232. **Uruguay: Agricultural Progress in Uruguay.** — In the "message" presented by the National Council of Administration to the General Assembly of March 1924 the following report of the work of the Commission for the Promotion of Agriculture during 1923 was given. In order to comply with the requests made by agriculturists, the work of the Commission was considerably increased during the year, its chief activities including the following: Inspection of growing crops; treatment of seeds and use of fertilizers; manufacture and sale of insecticides and fungicides; supply of seeds on credit; advisory service; inspection of orchards and vineyards; treatment of plant diseases; assistance to agricultural colonies; inspection of plant nurseries; organisation and inspection of co-operative fruit-growing societies; ploughing competitions: co-operation in agricultural fairs and in the farm and cattle census; plant and seed inspection at ports; measures for the control of locusts.

Inspectors made 2446 crop inspections and 4709 inspections at ports, where 701 lots of plants or seeds were fumigated, 1252 inquiries were answered by the Central Office, and 186 seed analyses were carried out. The work of the supply department increased appreciably, 16,590 kg. of insecticides and fungicides and 3878 litres of similar products having been distributed by agents in all parts of the country. (*Bulletin of the Pan-American Union*, p. 727, 1924).

Miscellaneous.

233. **Brazil: "Curaua", the new Brazilian Textile Fibre Plant.** — At Taperinha, near Santarem, the most important town on the Lower Amazon (State of Para), the Swiss naturalist Dr. G. HAGMANN, who has been a resident for many years in the district and is an official of the municipality of Santarem, is cultivating an extensive plantation (500 ha. 500,000 specimens) of the "curaua", a member of the Bromeliaceae, which is reputed to yield one of the strongest textile fibres in the world. Leaves of two year old plants are already fit to be gathered and are on an average 1.20 metres long The 500,000 plants mentioned will yield 150 metric tons which sold at the same price as "sisal" would give a return of 420 contos of reis. In the opinion of experts the fibre is suitable for making all kinds of textiles and twine. In view of the fact that on the Brazilian market there is an immense demand for textile fibres of every kind it is estimated that Dr. G. HAGMANN will be able to increase the number of his plants to 300 000, sufficient to yield 900 metric tons of fibre, bringing a return on the basis already quoted of 2520 contos de reis. (*Brazil Ferro-Carril*, Year XV, Vol. XXVII, No. 374).

234. **A New Coffee Picking Process.** — At the meeting of the *Sociedade Rural Brazileira*, held 14 May 1924, Sig. I. do AMARAL CASTRO explained a method of coffee picking which should be much more profitable than the method at present in use. He calls it "natural harvesting" (colheita natural) and the plan consists in removing from the plantation, by means of besoms or any ordinary brooms, the fallen coffee berries at periods of about two months, so as to prevent the product remaining on the ground too long. One man, with an ordinary broom, sweeps and shakes on an average 200 coffee bushes a day, thus obtaining a larger daily work yield than by the usual process. The harvest should be accomplished in two periods, and there should be a definitely calculable yield, since it would be removed from the ground at

the proper times of ripening and thus there would be avoidance of the loss of a large quantity of coffee which would spoil if left longer on the ground. The process of gathering could be carried on equally well on rainy days and in a hot sun ; this would much facilitate the work which would hardly occupy more than one minute per plant.

In the *Revista da Sociedade Rural Brasileira* (Year V, No. 48, p. 187, 1924) a table is given showing a comparison of the different states of ripening of the berries gathered both by the " usual " and by the " natural " process and the superiority of the latter is shown.

235. **Spain: Catalogue of Plants in the Garden of Acclimatization of Orotava (Canary Islands).** — This catalogue has been published at Madrid by the Dirección general de Agricultura y Montes, Ministerio de Fomento. It is prefaced by a historical introduction, by F. MENÉNDEZ Ing Agr (Santa Cruz de Tenerife) and is illustrated by four large illustrations representing specimens of this extensive collection.

The Garden has been in existence over a century having been founded by King Carlos III of Spain by a Royal Ordinance of 17 August 1798. It is situated on the " Durazno " estate between Puerto de la Cruz and Orotava, at an average height of 95 metres above the sea, and has an area of 10.749 hectares (*Catálogo de las plantas existentes en el Jardin de Aclimatación de La Orotava,* Canarias, Madrid, 1923)

236 **France: The "Verdissage" of seeds.** — Attention has been drawn by M. VERMOREL, member of the Académie d'Agriculture to a method which he calls " verdissage " of seeds and which offers certain advantages as compared with the various processes now in use (sulphur treatment, treatment with formalin, Bordeaux mixture, or hot water etc.), with the object of protecting seeds from rust or smut. In the course of an enquiry made at the Ville-Franches. sur-Saone Viticultural Station, the author made an estimate of the losse- in germination capacity resulting from the methods in use. The Americans who have noticed the disadvantages of the wet methods with sulphate of copper, have lately tried to substitute a dry method The Berkeley Station has discarded copper sulphate which does not adhere properly to the seeds, on account of its crystalline structure,and have finally replaced it by copper carbonate.

After a number of experiments, the Viticultural Station of Ville-Franche-sur-Saone has decided on the use of neutral coppper acetate (verdigris) reduce to a fine powder in which condition it adheres well to all seeds.

100 to 150 gm. of acetate per 100 kg. of wheat is quite enough. This process of " verdissage " of seeds would be economical, practical and easy of manipulation, and would give the same security against rust and smut in the case of cereals as the other methods in use, thus avoiding serious losses of germinating capacity

237. **United States : Construction of a Reservoir in Idaho.** — The scheme has been approved and contracts taken up for the construction of this reservoir at the American Falls in Idaho, with the object of supplying water for the irrigation of about 1 500 000 acres of land in the Snake River Valley, one of the best watered valleys of the United States The cost is estimated at 8 000 000 dollars. The reservoir will be about 25 miles long and 12 miles wide

and the mean depth will about 40 feet. The increased value of the crops, as the result of this additional irrigation is calculated at 40,000,000 dollars annually. (*New Reclamation Era*, Vol. 15, No. 11, p. 176 Washington, D. C., 1924).

238. **United States : The Italian Silo.** — In the Experimental Agricultural Station at Wisconsin tests have been carried out by W. H. PETERSEN and L A. BURCKLY on two examples of the Italian method of ensilage. The ensilaged forage consisted of lucerne containing from 30 to 40 % moisture and enclosed immediately on introduction into the silo. As is well known, the Italian process of ensilage consists in burying half-dried forage in trenches impermeable to water and subjecting it to rapid and heavy pressure (at least 10 quintals of weight per square metre) so as to keep it as much as possible from the air and to hinder the rise of the temperature of the whole mass. During the 100 days of ensilage the experimentors took the temperature, and the bacteriological content, at fixed intervals, and also made a chemical and bacteriological analysis of the buried lucerne. It was shown that the composition of the lucerne remained nearer to the original state, the microbiological content was lower and the fermentation temperature less than in the maize silos prepared with damp and overheated forage (*Hoard's Dairyman*, Year 66, No 4, p 80, 1924)

239. **Great Britain : Yeoman II, a New Seed Wheat.** — The Council of the National Institute of Agricultural Botany, Cambridge, is placing upon the market about 2 500 quarters of a new seed wheat, Yeoman II, bred by Prof R H Biffen The wheat will be sent out in sealed sacks, the price will be £6-6-0 per 4 ½ cwt Yeoman II is intended to take the place of the older Yeoman wheat, to which it is superior Both wheats are products of Browick Red Fife Reports have stated that bread made from the flour of Yeoman II is incomparably superior to that obtainable from the average English wheat It is particularly suitable for medium and heavy soils. (*Nature*, Vol. 114, No 2859 London, 1924)

240 **Sugar Beet Industry.** — The Government subsidy of 19/6 per cwt on home-grown sugar will have an immediate effect in Great Britain on the Sugar-Beet Industry In addition to the two factories now in existence six more are to be erected, involving the permanent investment of over £2 000 000. (*The Agricultural Gazette*, Vol. C, No. 2461. London, 1924).

241 **Palestine : Afforestation in Palestine.** — Nearly 2 000 000 trees have been planted during the period 1920-1924, in which work the Forest Service has rendered valuable aid Assistance has been given by the Zionist Executive and the Supreme Moslem Council and planting work has been done by municipalities, private persons and villagers. During the same period nearly 1 000 000 vines were planted of which 700 000 came from Government nurseries. (*The Commercial Bulletin*, Vol. VI, No. 67 Jerusalem, 1924)

242 **Canada : A Vegetation and Forest Cover Map of Canada** has been published by the Natural Resources Intelligence Service of the Department of the Interior The map shows the different zones of vegetation, from those in the north which will support only a growth of hardy grass, to the almost sub-tropical fruit belt of southwestern Ontario Information is given which has been obtained from the notes of both the earlier explorers and surveyors and those of more recent date (*Scientific Agriculture*, Vol V, No 2, Ottawa, 1924)

243. **India: Aerial Map of the Forests of the Delta of the Irrawaddy.** — An aerial survey under direction of the Survey of India and Burma Forest Departments of 1300 square miles of forest in the Irrawaddy Delta, was undertaken in order to provide maps of the Delta forests and also to supply information regarding the distribution of the different types of forests. Between 3000 and 4000 photographs were taken. Owing to the difficult and swampy nature of the ground the survey of these forests on the scale of 3 inches to 1 mile by the ordinary method would have taken much longer and would have been much more costly than by the aerial method. (*The Indian Forester*, Vol. L, No. 8. Dehra Dun, U. P., India, 1924).

244. **Union of South-Africa: Röntgen Rays and the Examination of Fruit.** — The Ministry of Agriculture for the Union of South Africa is engaged in encouraging the increased exportation of fruit, and in the investigation of methods for ascertaining the presence of damaged fruit which can readily be carried out before loading, and will thus obviate the financial loss incurred from carrying unsound fruit on the vessels. The method used for distinguishing sound from rotten eggs suggested to W. MALLEY the idea of utilizing the Rontgen rays also for fruit. It is possible in this way to discover damage due to the larvae of insects not visible externally, or to ascertain when the fruit is over ripe, even when there is no external indication. The radiological apparatus would not be within the reach of the individual farmer, but it should and will be possible to construct the necessary plant, on an easily worked model, for one of the large export businesses. (*Die Umschau*, Year XXVIII, No. 45. Frankfort-on-Main, 1924).

245. **The Cane Sugar Industry.** — A brief descriptive account is given by G. GARBIN of the history of the industry, the characteristics of the sugar-cane and of its cultivation, and the methods of extraction, comparative figures being quoted for the different cane sugar producing countries, and including a diagram of the world production of cane sugar and beet sugar of the period 1850 to 1924. This study presents a certain interest, apart from that relating to the comparison between the two different industries which supply the same product, and thus are in a sense rival It emphasizes the idea of a possible profitable cultivation of sugar cane in Somalia, and suggests its re-introduction into Sicily as a crop to be grown under modern methods and on a commercial scale on the same land where it was introduced many years ago and fell out of cultivation partly for political reasons and partly owing to degeneration caused by the presence of local varieties. (GEROLAMO GARBIN. *The Sugar Cane Industry, Importance of the World Production and Possibility of Development in the Italian Colonies and Sicily*, pp. 18, small 4to. with illustrations and diagrams. Milan and Rome, s. d.).

246. **Jamaica: The "Uba" Sugar Cane.** — The annual report of the Department of Agriculture states that the year in question (1923) was chiefly remarkable for the campaign against mosaic disease. Uba cane proved of great service owing to its immunity from this disease; this cane is hardy and gives a larger tonnage than any other on the island. At the Hope Experiment Station 35 seedlings have been obtained by crossing Uba with large West Indian varieties. (*International Sugar Journal*, Vol. XXVI, No. 309. London, 1924).

247. **Netherlands : Catalogue of the Geological and Agrogeological Collections of the Wageningen Higher School af Agriculture.** — This catalogue has been published as part 27, No. 3 of the Mededeelingen van de Landbouwhoogeschool of Wageningen. It consists of 152 pages in 8vo. and the list of the specimens in the collections is accompanied by a bibliography with 55 references. The geological collections are representative of the various regions of Holland (Southern Limburg, Northern Limburg and Brabant, Central, Eastern and Northern Holland, Zuiderzee, Noordzee, Western and South-Western Holland) as well as the colonies (Sumatra, Java, Timor, Borneo, Celebes. Molucca, etc.). The agrogeological collections represent also the various European countries, Africa, Western India and China. (*Catalogus der geologische en agrogeologische Verzamelingen van de landbouwhoogeschool te Wageningen.* Wageningen, 1924).

248. **Porto Rico : New Varieties of Sugar Cane.** — The Annual Report of the Insular Experiment Station for 1923 gives interesting details respecting sugar cane varieties now being tested ; BH 10-12 and Saint Croix 12-4 both give heavy tonnage and high yields of sugar, and both are resistant to drought and more resistant than is usual to mosaic disease Cane D74 and Badilla are being propagated for distribution Uba is absolutely immune to mosaic and gumming, but the sucrose content varies greatly with soil and climate (*Int. Sugar Journal*, XXVI, No. 308 London, 1924)

249 **Sweden : Protection of the European Buffalo.** — An effort to save from extinction the European buffalo, said to be the rarest living mammal in the world, has been begun at Stockholm with the opening of a 100 acre preserve, where these animals will be allowed to live and breed under natural conditions. Out of a total of only fifty-six European buffaloes known to be living at the present time, seven are to be found in Sweden and up to the present this herd has been kept in the open-air museum of Stockholm. (*Science*, Vol LX, No. 1556, 1924)

250. **Czecoslovakia : Electrification of Country Districts.** — With a view to the promotion of rural electrification, the Council of Agriculture of Prague has recently founded an Experimental Institute with the following objects : (*a*) the study of the relation of electricity to agriculture in general ; (*b*) the study of the development of rural electrification in other countries ; (*c*) the experiments in electrical power etc. at Dražice (where the Central Cooperative Electrical Works are situated) and at the Higher School of Agriculture ; (*d*) the co-ordination of the experimental data in view of the possible application to practice ; (*e*) information to agriculturists on the value of electrification , (*f*) all work within its competence as Council for electrification. The Czecoslovakian Minister of Agriculture had allocated in the budget of 1924 the sum of 3,000,000 crowns for subsidising the construction of lines for the distribution of the electric power in the communes (*Publication du Ministère de l'Agriculture de la République Tchécoslovaque*, 1 vol. 8vo., 1924).

Journals and Reviews.

251. **A Proposed Biographical Entomological Dictionary.** — In the *Entomologist* (March 1924) and in the *Entomological News* (May 1924) Professor E STRAND, Director of the Scientific Zoological Institute, University of Riga

(Latvia), has set out his scheme for publishing a dictionary containing the autobiographies of all the entomologists and arachnologists who have, either as authors or collectors, contributed to the progress of entomology. All persons who have done work with insects or spiders are invited to send autobiographical notes to Professor STRAND, 9 Kronvalda bulvars, Riga, Latvia, or to facilitate the collection of the autobiographies of Americans, they may instead be sent to Dr. H. P K ÅGERSBORG, Department of Biology, The James Millikin University, Decatur, Illinois, who will forward them to Professor STRAND. (*Science*, N. S., vol. LX, No. 1558, 1924).

252. **A New Review of Biological Science.** — Under the title "*Biologia Generalis*" is now being published at Vienna and Bratislavia a new periodical containing original articles relating to the three principal divisions of general biology, viz. morphology, physiology and general ecology. It is practically international in character and accepts scientific communications in five languages : French, English, Italian, Russian and German. The Editing Council consists of Professor V RUSICKA, Institute of General Biology, Prague ; Professor L. LOHNER, Institute of Physiology, Graz : Professor R PEARL of the *Johns-Hopkins University*, Baltimore, Maryland, U S. A. Scientists of high reputation in biological studies have promised their collaboration The publishers are E. HAIM and Co , Vienna I, Maria Theresienstrasse 10 and Bratislavia, Czecoslovakian Republic)

253 **New Austrian Timber Review.** — Under the title of *International Holzzeitung* the first number of this review was published in August 1924 in Vienna (I Passauerplatz 2)

254 **New German Review of Rural Engineering.** - Is published in Pomerania (Kreisdruckerei Greifenburg) as a monthly periodical, under the title of *Ratgeber fur den Maschinbetrieb in der Landwirtschaft*

255 **A Specialized Periodical for Chemical Laboratory Practice.** — This new publication (*Die Laboratoriumspraxis*) was first issued on 1 January 1925 and will appear twice a month dealing with the whole field of applied Chemistry It is being published, on the initiative of the *Reichsberufsausschuss fur Laboratoriumstechnik*, by the *Industriebeamtenverlag*, Berlin, N W, 52 Werftstrasse.

256. **A New Agricultural Review in Guatemala.** — Under the title "Agricultura" the General Agricultural Association of Guatemala has initiated the publication of its own official organ which, besides giving a full account of the work of the Association, will contain various articles on scientific agriculture, notices of legislation, and of official administrative measures, etc.

257. "**Landbouwkundig Tijdschrif**" is the title of a new monthly review, published by the Dutch Farmers' Association in substitution of the old *Cultura*. The first number contains an article by Professor E. LAUR on international agricultural organisation in the future, and one by J. C. T. UPHOF on researches in fruitgrowing in the United States, in the other numbers of 1924 there are many other interesting papers and articles.

258 **A New Russian Agricultural Review.** – The first number of the "*Journal of Experimental Agriculture of South-Western Russia*" has been published at Saratov. The editing committee is composed as follows : W. R.

ZALENSKY, G. K. MEISTER, E. I. PANFILOFF, F. P SAVARENSKY and N. M. TULAIKOFF.

259. **A New Periodical of Chemistry for Central Europe and the Balkans.** — The *Chemische Rundschau fur Mitteleuropa und Balkan* has been established at Budapest and will serve at the same time as the organ of the Association of Hungarian Chemists. Editor-in-chief, Dr. L v. VASAHEVI. The periodical appears weekly.

Personal

260 STEPHEN MOULTON BABCOCK, the inventor of the "Babcock Test" for the determination of the percentage of fat contained in milk, and formerly Professor of Agricultural Chemistry at the University of Wisconsin has celebrated his eighty-first birthday

261 JAMES BRITTEN, English botanist and for 40 years editor of the *Journal of Botany*, died on 3 October 1924, at the age of 79.

262. Dr MAX BÜCHELER, Professor of Agricultural Technology at the Higher School of Agriculture at Weihenstephen has completed the fortieth year of his professional activity He is well known authority on the theory and technique of distilling, and his process for the preparation of artificial fertilisers by means of mineral acids is largely used At the Higher School of Agriculture at Weihenstephen he undertook the direction of the distillery in 1898 and in 1908 the direction of the School of Distillation

263 Professor KARL CORRENS, Director of the "Kaiser Wilhelm Institute for Biology" in Berlin-Dahlem, who is especially well known for his researches on plant heredity, kept his sixtieth birthday on 19 September 1924.

264 The English Botanist, WILLIAM BOTTING HEMSLEY, custodian of the herbarium of Kew Gardens, died at the age of 80 on 14 October 1924

265 The "Darwin" medal of the Royal Society of London has been conferred on Dr THOMAS HUNT MORGAN professor of Zoology at the University of Colombia, in special recognition of his research work on the laws of heredity.

266 An honorary decree has been conferred on Dr. HEINRICH LUMBE, founder of the famous Bird Protection Park at Aussig, by the University of Vienna

267 Professor JULIUS STOKLASA, well known for his valuable research work in the field of agricultural chemistry and biochemistry, Professor of the Higher Technical School at Prague, Director of the Czecoslovakian Experiment Station for Crop Production, and First Acting President of the Czecoslovakian Institute of Agriculture, has celebrated the fortieth anniversary of his scientific career.

ALFREDO RUGGERI, *gerente responsabile.*

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NOTE. — The Bureau assumes no responsibility with regard to the opinions and the results of experiments outlined in this *Review*.

The Editiors notes are marked (*Ed.*); the letter *R.* indicates the references to the foregoing issues (Monthly and Quarterly) of the International Review.

ORIGINAL ARTICLES

RADIOACTIVITY OF THE ERUPTIVE GASES OF MT. VESUVIUS AND OTHER SOLFATARA VOLCANOES, AND THEIR INFLUENCE ON THE DEVELOPMENT OF BACTERIA AND OF HIGHER VEGETATION.

It would be of great interest to ascertain whether the gases actually emitted by the volcano are radioactive and to what degree. For this purpose experiments were made with respect to the electric conductibility of gases emanating not only from Vesuvius itself, but also from the Campania.

The electric conductibility of these gases depends on their radioactive elements. The results obtained are of great importance, not only as regards physics, but in respect to chemistry, geology, and above all, physiology. The tests were carried out on Mt. Vesuvius, at Pozzuoli, at Solfatara and at Posillipo, and confirm the accuracy of previous results obtained on Mt. Vesuvius and on the Campania. Four months before our visit a new crater called the Forum Vulcani burst open at Solfatara; the fumeroles reach a temperature of 500-600°C. The various gases emitted by this new crater contain besides steam, hydrogen compounds, more especially ammonia and sulphuretted hydrogen. These compounds have been found to be radioactive.

By means of the GERDIEN apparatus the electric conductibility was ascertained of the gases emitted by Mt. Vesuvius and the newly formed crater, Forum Vulcani. The electric conductibility of gases directly given out by Mt. Vesuvius, could not be studied, because new formations made its crater both inaccessible and dangerous.

These gases were therefore tested when diluted by contact with air and the electric conductibility of the atmosphere was found to be as high as $4.8.10^{-4}$ U.E.S.

The conductibility of gases at their actual exit from the volcano is undoubtedly much greater than shown by our tests. Atmospheric electric conductibility in close proximity to the crater reaches $4.5.10^{-4}$ U.E.S. The atmosphere below the volcano itself shows an electric conductibility of $1.2.10^{-4}$ U.E.S. and both at Pozzuoli and at Posillipo an atmospheric electric conductibility of $2.4.10^{-4}$, and up to $2.6.10^{-4}$ U.E.S. was recorded.

It should moreover be noted that there are present everywhere at Pozzuoli and at Posillipo, fumeroles emitting radioactive gases. At Naples, the atmospheric electric conductibility was found to be $0.9.10^{-4}$ U.E.S.

These are the first practical studies made of atmospheric electric conductibility produced by radioactivity on Mt. Vesuvius. Conductibility in this instance is twice as strong as that of the atmosphere at Jachymov (Joachimsthal), near the radium factory.

The atmospheric electric conductibility at Jachymov was $2.4.10^{-4}$ U.E.S.; at Karlovy Vary (Karlsbad), $1.0.10^{-4}$, U.E.S., and at Rome $0.7.10^{-4}$. Gases exhaled by the crater Forum Vulcani at Solfatara, show an electric conductibility of $2.8.10^{-4}$ U.E.S. and as high as $3.6.10^{-4}$ U.E.S.

The same degree of conductibility has also been found in the case of gases that have been diluted by contact with air. The figures stated are an average resulting from very numerous tests.

Tests were also carried out over the sea near Messina, at Patras in Greece, at Ragusa and at Trieste; electric conductibility in these cases reached 0.6 to $1.2.10^{-4}$ U.E.S. In all these tests allowance was made for atmospheric humidity and temperature.

Similar tests were made at Paris, above and below the Eiffel Tower. Atmospheric electric conductibility rose to: $0.4.10^{-4}$ U.E.S. below, and $0.8.10^{-4}$ U.E.S. above the Tower.

It was of the greatest importance to ascertain the condition of the atmosphere above the potash beds of Mulhouse, as potassium is radioactive and gives out Beta rays. The atmospheric electric conductibility at Mulhouse was found to be $0.8\text{-}1.0.10^{-4}$ U.E.S., whereas underground in the salt mines ($NaCl$) it was $0.4.10^{-4}$ U.E.S., and in the layers of potassium salts (KCl) conductibility rose to $2.8.10^{-4}$ U.E.S. In the wooden sheds of the factory where the potash salts lay heaped up it was $3.6.10^{-4}$ U.E.S. and in the empty wooden sheds, $1.0.10^{-4}$ U.E.S.

The atmospheric electric conductibility in the potash mines is thus as high as that of Mt. Vesuvius.

Owing to their content of radioactivity, the gases emitted from Vesuvius possess extraordinary physiological influence. Sulphurous acid formed by the oxydation of sulphuretted hydrogen is immediately transformed into sulphuric acid and can therefore have no injurious influence on vegetation. The injurious gases that destroy all vegetation on the top of Mt. Vesuvius are fluorine compounds.

Atmospheric radioactivity as well as radioactivity of the soil favours the development of leguminous plants especially of *Spartium junceum* and *Robinia pseudoacacia*, which are amongst the pioneers of vegetation. Nitrogen-fixing bacteria especially thrive on radium emanations Alpha rays favour de-nitrification by bacteria, and increase their respiration, provided there is an excess of oxygen present. The process of de-nitrification by nitrogen-fixing bacteria is in genetic connexion with the power of nitrogen-fixation in the air. Thus, it is noted that nitrogen-fixing bacteria are extensively found, not only on the lower slopes of Mt Vesuvius, but also in the soils of the Campania These soils are characterized by very high radioactivity. These investigations show that soils covered by a luxuriant vegetation have a radium content of 3-5 10^{-1} g. pro. g. Throughout the Campania the productive capacity of plants is a striking feature while fruit is gathered three times a year

The hydrogen-ion content of these soils varied between pH 6.8 and 7.5. These soils are therefore neutral.

In the South, photosynthetic processes develop more rapidly under the influence of a greater intensity of sunlight, of heat, and of the action of nutritive mineral matter in the soil Rays emanating from radioactive bodies, more especially the Beta and Gamma rays, the influence of which acts on the leaves, have an entirely different effect than in our colder countries. Carbo-hydrate production is so intense that oxydation due to Alpha rays from radioactive bodies produces no diminution in it.

The radiant energy of the sun, which in the chlorophyll cells brings about the synthesis of organic matter by the aid of inorganic substances, is related to the Beta rays emitted by potassium. These Beta rays, penetrate the entire chlorophyll cell and certainly react on the process of photosynthesis and on the production of organic substances by the assimilation of carbonic acid.

These experiments show that the endothermic fundamental process that brings about photosynthetic assimilation of carbonic acid, is merely the decomposition of bicarbonate of potassium under the action of light and radioactivity, with the production of formic acid, oxygen and carbonate of potassium as well as the decomposition of formic acid and the production of formaldehyde and oxygen.

This photosynthetic process must be influenced by the radioactivity of potassium.

From the numerous experiments carried out during the last three years, it is concluded that photosynthesis in the chlorophyll cell is assisted by Beta and Gamma rays emitted from various radioactive substances.

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THE BENEFICIAL AND INJURIOUS EFFECTS OF SHORT-WAVE RAYS IN NATURE.

Observations, carried on over a period of 30 years, with regard to the action of different forms of energy on the germination capacity of seeds repeatedly brought to light whole series of, in some instances, very significant cases of disease in 1300 kinds of seed. These diseases, caused in some cases by too strong concentrations of energy, were often difficult to determine, because the symptoms were frequently not uniform. In particular, the author did not for a long time recognise the nature of the serious injuries constantly occurring when seeds germinated in the dark were exposed to the light, because side by side with quite characteristic individuals with closely joined cotyledons, all kinds of stunted forms appeared, which alternatively were combined with more than 50 % of individuals destroyed before germination. The author has described in detail these effects of radiation in his publication "Frost und Licht", 1912-20. The seeds of *Amorpha*, which are particularly well suited for the solution of the problem, provided the opportunity for a series of tests, the peculiar nature of their small husks making possible an application of six different forms of energy. The tests could be carried out on the seeds when still covered by the husks and rendered immune by an abundance of essential oil both within the husks and on the epidermis of the seeds themselves, also on the seeds separated from the husks, surrounded with a layer of resin oil, and finally on the seeds when released from this layer after four hours treatment with alcohol. In this way it was possible under the influence of light and also by shutting off light, finally so to check the respiration in the light, in conditions of its highest stage of freedom (1) (alcohol test), that the limit of the respiration beneficial to the progress of seed germination was passed, and henceforth in contradistinction to the results of the two first parallel series of tests, a simple germination in the dark was obtained. Here in the last series of tests a 100 % germination in the dark was already reached after 26 days, whereas when respiration is impeded by the husks germination stops earlier at 12 %, and the small quantity of light passing through the husks will probably take a whole year (as in other cases) to have any effect in bringing about germination to the same extent. The short table which is given later, shows clearly that, at the medium rate of respiration (hulled seeds only), a similar reading results as in the case of almost all seeds of wild leguminous plants, showing in fact that germination in the light during the course of a year constantly proves slightly better than in the dark, so much so indeed that in extreme cases certain of the seeds remaining in the dark germinate many years later than those to which the light had access. In many leguminous plants growing on sandy soils, such as *Spartium junceum* and *Sarothamnus scoparium* (Broom), germination in the dark is much more strongly suppressed, so that in a number of years only ⅓-½ of the seeds arrive at germination. At an earlier stage it was clearly proved in the case of the large seeds of *Calycanthus praecox* that the hulled seeds germinated in the dark in one month up to 100 %, whereas in the light there was only 30 % of moderately healthy germination, while the remainder, in addition to 50 % killed, showed the types mentioned with close pressed cotyledons in all stages up to the diseased stunted forms. On the other hand with the protection of the thick husk it was only after 18 months that the effect of the small amount of light that penetrated the seed cases became noticeable, so that the germination which then stood at 0 : 18 % (D) in the next period in the dark reached 20 % and was arrested there, while only after that in the following months, in consequence of the reduced penetration of the rays, did the germination proceed steadily and normally (compare *Amorpha*).

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(1) It may be noted in this connection that according to VERSCHAFFELT, an increased freedom of respiration and further swelling can be brought about at pleasure by longer alcohol treatment The oil is removed in a very short time

Later investigations showed, apart from many other excellent examples for our subject, that in the case of *Prunus Padus* (bird-cherry) which germinates in the dark and below freezing point, in addition to a normal germination in the dark and below freezing point complete in 12 months, there were after the lapse of that time only 4 % in the light at a temperature of 20°C. of instances of fairly normal germination, while after 2 ¾ years at 20°C. many examples were noted with close pressed cotyledons, besides over 30 % which died before attaining any real development. Similar records of injury (50 % killed) were established after some years of observation as due to the influence of light at a temperature below freezing.

In other instances again, on elimination of the factor of frost, development at 20°C. is extraordinarily slow, but at the same time, owing to the protecting seedcases, quite normal. A good example of such instances is supplied by the large black seeds of the peony (*Paeonia*) with which the author has been carrying on this experiment for 14 years. With these seeds the above mentioned reversal of behaviour, due to the penetration of a very small quantity of light (1), only came about in ten years, while arrest of germination in the dark was noted in the case of 42 % in 6 years, followed by a slower progress up to 67 % in 14 years As the ratio of the development is important for our enquiry, the figures for the separate years may be given The figures in the following statement may be taken as correct for over 800 different kinds of land plants

In cases where germination was originally simple germination in the dark (cf *Amorpha*, *Calycanthus*, etc), in the first year the proportion of light to dark germination was, in the first half year, 0 11, after one year 4 22, after 2 years 8 37, after 3, 10 · 38, after 4, 12 · 40, after 6, 31 42, after 8, 38 . 42, after 10, 46 42, after 11, 54, after 12, 58, after 13, 64, after 14, 67 Darkness and freezing together bring about the full germination in this instance usually after several years, and even at a temperature of 20°C. no deterioration took place, owing to the protective seedcases (in contradistinction to the case of the bird-cherry) The plants develop quite normally and the author has in his garden healthy, regularly flowering, peonies of many year's growth.

The quantity of energy that penetrates the seedcases is so small that paper sensitive to daylight is not darkened even in long periods (*Daphne* tests) It remains to determine in each case the nature of

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(1) It is highly probable from the colour and formation of the seed case in the examples mentioned above that the light which has gradually filtered through the protecting husk over long periods of time contains a preponderance of red and ultra red rays, while in other instances much shorter wave lengths up to the ultra violet may be present

Special note should also be made of the simple germination in the dark of *Passiflora* (black ribbed seedcases) which in the 13th year remains at 37 out of 96 the deterioration of the seeds of *Nigella* which become tolerant of light at 20°C (also *Allium*, *Porrum* etc); also the injury from frost and light occurring with the seeds of *Oenothera*, *Trollius*, *Prunus spinosa*, *Parietaria*, *Cucubalus Vaccaria* (serious injury) *Cerinthe*, all of which seeds are shaded, i e contained within thick walled seedcases, also the seeds of *Myricaria*, *Peplis*, *Sedum acre*, *Limosella*, numerous kinds of *Veronica* (especially *V officinalis* and *V peregrina*), all of which are exposed to the light these rays. The colour table given in "Frost und Licht", 1913, p. 144, should also be compared, showing the action of coloured light on matt photographic daylight-sensitive paper, after 15 and after 90 minutes.

Of late, the investigation which has been already described as carried out on *Amorpha*, and was made possible by the special characteristics of its seeds, has acquired much significance, as it has supplied, in agreement with earlier experiments of which only this brief mention is possible here, a long-desired explanation relative to the extent of the effect of the rays. The following short table makes it possible to form an idea of such effects as have already been described, as compared with other effects determined in shorter periods.

Germination of Amorpha fruticosa (constant temperature of 20°C.)

Number of days elapsed		1	4	5	6	9	10	11	12	13	15	16	17	18	19	22	23	24	25	26	33	
		Percentage germinated																				
Light . .	a)	—	—	—	—	—	—	—	2	—	4	—	—	7	11	[illegible]	—	—	—	—	—	Further germination in the course of years
	b)	—	—	—	—	—	3	13	15	[illegible]	40	52	[illegible]	63	68	73	74	75	—	—	77	
	* c)	—	—	—	—	3	7	8	11	16	35	44	55	50	66	79	80	81	83	84	87	
Dark	a)	—	—	—	1	4	—	6	8	—	10	11	—	—	—	12	—	—	—	—	—	Slow progress or cessation.
	b)	1	—	—	—	2	—	6	14	20	37	46	55	60	67	70	73	74	—	—	76	
	c)	-	4	6	7	8	11	[illegible]	6	25	48	57	68	73	84	93	94	95	96	100	—	

(*a*) Seed in husk after 40 days, 17 12

(*b*) Hulled seed with a natural layer of resin oil

(*c*) Oil removed by alcohol (96 %) 4 hours steeping etc.

An equable temperature of 20°C in the case of germinating seed is always to be understood in articles by the author, if no other temperature is stated

A clear conception of the rapidity of the action of the rays is supplied by the recent investigations of E LEHMANN and RAO LAKSCHMANA as to the validity of the law of production in the case of germination in light of *Lythrum Salicaria.* The authors with an illumination of 200 candle-power for 5 minutes, and with one of 50 candle-power for 15 minutes and a third of 5 candle-power for three hours, established almost the same percentage of germination (an average of 46 %) in each case, as the total amount or effective radiation was during these three periods practically the same. The following were the results:

Illumination	Period of exposure	Light Power c p × sec.	Percentage of germination
5 c. p.	3 hours	54,000	45.25
50 »	15 minutes	45,000	49.72
200 »	5 minutes	60,000	43.00

These highly valuable and precise results provide a sound basis for the comprehension of the extremely slow progress of germination under a still smaller number of rays.

Reference will now be made to the experiments on short-wave light of the oculist SCHANZ (1), whose premature death is much regretted. SCHANZ showed that eosin solutions, introduced into the circulatory system of the plant, bring about the same striking developments which are known to be typical of alpine plants with stunted stem branchings If this fact as established by SCHANZ be compared with the recent results on seed germination, a clearer idea will be obtained as to many of the remarkable processes of retardation in the growth of young plants as described in this article. The reason why the real effect in the case of the short-stemmed individuals only gradually became evident to the author may be explained, on the one hand, by the large number of tests undertaken and, on the other, by the fact that only individual forms of development were suitable for recognizing the now well understood action of the short-wave light. SCHANZ's last published work on the subject is to be found together with a summary of his other publications in the treatise " Erscheinung der optischen Sensibilation bei den Pflanzen " in the report of the German Botanical Society (Deutsche Botan Ges), 1923 No. 25, pp 167-170 SCHANZ proved that eosin introduced into the body of an animal (by feeding eosin barley) (1), and into the human body, produces symptoms similar to those observed under the designation of ' glacier burn '. If in conjunction with this well recognised photodynamic effect of eosin, established as it is by numerous biological tests, there is considered the similar effect of quinine, which also acts photodynamically, a further, and no longer very suprising point of view is reached

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(1) Also to the works of E MERKER

(2) With regard to eosin-fed pigs and eosin fed mice, the reader is referred to the foot note which follows on the feeds which only take effect photodynamically on white animals, or in a strong light, or in the combination of both conditions

It is a matter of common knowledge, and has been established beyond doubt by experience, that cattle which have been exposed for a long time to the intense rays of the sun readily contract slight nettle-rash if there is too sudden a change of temperature on returning to dark and chilly sheds. Similarly nettle-rash may be induced in a more or less severe form according to the particular case by certain feeds (1), the photodynamic action of which is still to be ascertained. Conditions however are less clear as regards the human subject. Besides quinine, certain foods such as strawberries, crayfish, etc., and also intense nervous strain may induce nettle-rash in varying degrees of severity, including that of nettle-rash fever. The author has himself for years past had an opportunity of observing in specially favourable circumstances that, in a case of nettle-rash originally probably brought on by change of climate, the rash which apparently had nearly disappeared kept coming out again at longer or shorter intervals, especially under conditions of great nervous strain It seems to the author therefore, in the light of what has been said, essential to take careful account, in order to find the true explanation of this hitherto mysterious disease, of these related phenomena, as he is convinced that herein may lie the key to a better understanding of this very unpleasant, though not usually dangerous, ailment A suitable form of treatment for the case of too sudden introduction into a climate poor in radiation would no doubt be comparatively easily found, thanks to the success of the modern treatment by light.

The author has welcomed the opportunity of submitting, after years of work, this brief review of a subject which originally lay outside the scope of his studies, since it is impossible to ignore the question how far the action of short wave light is present in other biological processes, and indeed even in apparently lifeless matter, in stones and minerals of all kinds. The decomposition of many artificially formed chemical compounds by short wave light is already sufficiently well known.

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(1) The course taken by the buckwheat rash in the case of white sheep, with even fatal effect at times, may be recalled The rash does not appear in completely black animals Also the influence of light on the after effects of beech mast (poisonous to horses), lupins etc

BIBLIOGRAPHY.

Kinzel, W., Frost und Licht als beeinflussende Kräfte bei der Samenkeimung. Eugen Ulmer, Stuttgart 1913-1920 (with tables attached).

Schanz, F., Einfluss des Lichtes auf die Gestaltung der Vegetation. *Ber. d. Deutsch. Bot. Ges.*, 1918, Vol. 36 and 1919, Vol. 37.

— Versuche über die Wirkung der ultravioletten Strahlen des Tageslichtes auf die Vegetation. *Pflügers Archiv für Physiologie*, Vol. 181.

— Die Physikalischen Vorgänge bei der optischen Sensibilation. *Pflügers Archiv*, Vol. 190.

— Erscheinungen der optischen Sensibilation bei den Pflanzen. *D. Bot. Ges.*, 1923, Vol 41, 25, pp. 167-170.

— *Fortschritte der Medizin*, Year 35, 1918, No. 28.

Lehmann, E and Lakshmana Rao, Ueber die Giltigkeit des Produktgesetze bei der Lichtkeimung von *Lythrum Salicaria* L. *Ber. d. D. Bot. Ges.*, 1924, 42, 65-69.

Merker, E, Das Verhalten feuchthäutiger Tiere im Lichte. *Zool. Anz*, 57, No. 9-13, pp 291-296. 1923

Zeller, Martin, Ueber die Wirkung des Lichtes auf das Ferment Katalase und die Sensibilisierung durch fluoreszierende (photodynamische) Stoffe, *Inaugural Dissertation*, Munich, 1907.

Guenther, Haematophorphyrinum comp. *Deutsches Archiv für klinische Medizin*, Vol 105, 1911.

Schumann, Haematophorphyrinum *Zeitschrift f phys. Chemie*, p 98, 1916.

Hausmann, Optische Sensibilisierung und photodynamische Wirkung. *Fortschritte der naturw Forschung*, Vol VI.

Fischer, Hans, Haematophorphyrinum, *Zeitschrift für biol. Chemie*, Vol. IX.

Meier, Betz, Experiment, Studien über Haematophorphyrinurie. *Inaugural Dissertation*, Munich, 1914 (I. and II, Med. Klinik).

Pinkussen, L. and Kato Naosaburo, Fermente und Licht. *Biochemische Zeitschrift*, 134, 470/136, 499/139, 352/142, 288 (1923).

Efimoff, W. W., Die photodynamische Sensibilisierung der Protozoen und der Satz von Talbot. *Biochem. Zeitschrift*, 1923, 453.

CULTIVATION OF WHEAT AND OTHER CEREALS IN ROUMANIA.

WHEAT.

The total area under cereals in Roumania is 2,690,341 hectares. The average yield per hectare varies greatly from one year to another owing to the very variable growth conditions, as well as to the tillage, which is generally carried out carelessly and in an unsatisfactory manner. Roumanian wheat nevertheless being of superior quality, is in great demand on the principal corn markets of Europe.

The climate of Roumania varies from year to year and according to the district, and this causes a marked difference in the quality and quantity of the yield. Similarly, the weight of a hectolitre of wheat varies greatly according to the year and district. The following table containing data relating to precipitation, will enable an opinion to be formed as to the variability of the Roumanian climate :

Year	Precipitation mm
1920	548
1921	507
1922	677
1923	544

The heat of the sun's rays is generally intense, which prevents the wheat-stalk from attaining its normal development.

Varieties. — The following species of wheat are generally grown in Roumania :

. (1) *Triticum sativum* Lam. (soft wheat), including the sub-species :

(*a*) *Triticum sativum vulgare*
(*b*) " " *durum*
(*c*) " " *spelta*
(*d*) " " *dicoccum.*

PLATE XXIV.

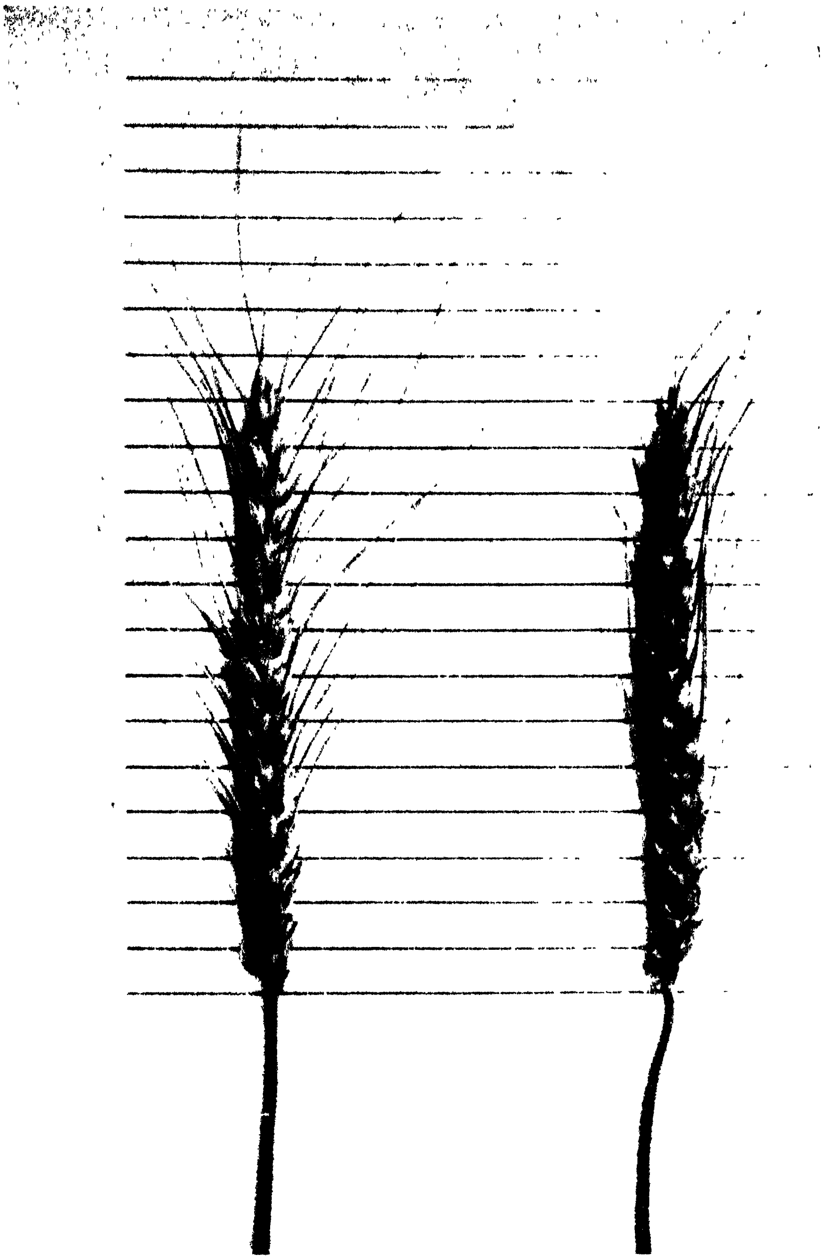

FIG. 63 — Wheat, improved white Roumanian.

PLATE XXV.

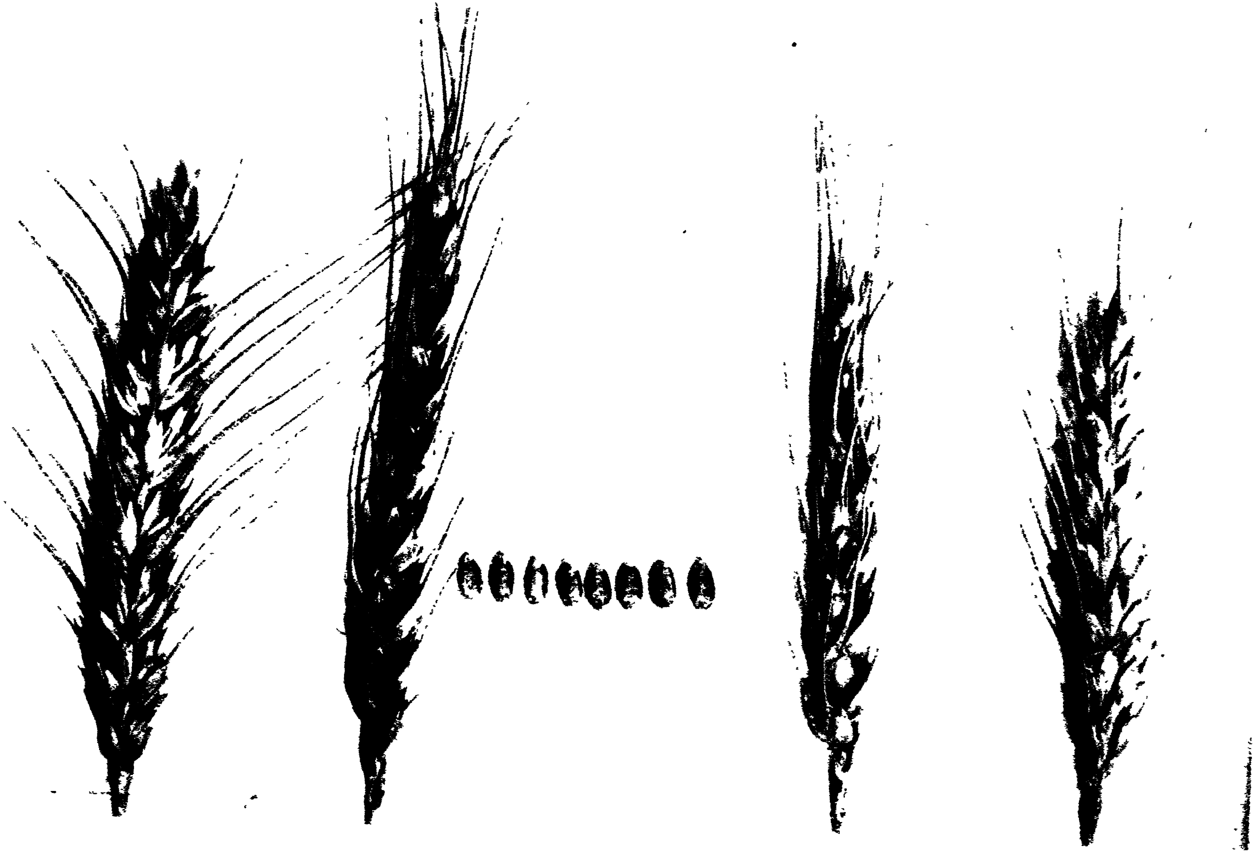

FIG. 64. — Wheat, red Roumanian.

The majority of the types grown in Roumania belong to the sub species *Triticum vulgare*, and include:

(1) *Triticum vulgare lutescens*: Ulka wheat,
(2) " " *miltura*: Ghirka wheat,
(3) " " *albo-rubrum*: Sandomir wheat,
(4) *Triticum vulgare erythrospermum*: white Roumanian wheat, Banat wheat, Baltatzel wheat.,
(5) *Triticum vulgare ferrugineum:* Roumanian red wheat.

Of the sub-species *Triticum durum* (hard wheat), the following have up to the present been identified in Roumania:

Triticum durum hordeiforme: Arnaoute wheat,
" " *leucomelan*: Turkish white wheat.

Of all these varieties the Roumanian white wheat and the Banat are the most extensively grown.

The Roumanian white wheat (Plate XXIV, Fig. 63) has a well-developed fasciculated root; the stalk is 1-1.60 m. long, with 4, 5 an sometimes 6 nodes.

The stalk is thinner and less resistant to bending than that of other species.

The leaves are 5 in number, of an average width of 1.08 cm., and much thinner than those of foreign varieties. The average length of the limb is 23 cm. In autumn the leaves are blueish-green in colour.

The ear is white, tapering towards the top, with narrow insertion. At its base there are always 2 to 3 sterile spikelets. Generally the glumes do not closely envelop the grain, so that the latter is liable to fall.

The grain is dark red, flinty in section, average length 7 mm., and 3 mm. wide; the envelope is thin as compared with that of foreign varieties. The weight of the hl. varies from 75-80 kg., that of 1000 grains from 28-37 gms. The Roumanian white wheat is a hardy species, well adapted to local conditions, early and very resistant to bad weather.

The Banat wheat has a strong yellowish-red stalk. The leaves are few in number. The ear is reddish-brown, awned, small, not thick, and about 15 cm. long.

The grain is reddish-brown, sometimes with yellowish red shades, flinty section, rich in protein and of superior quality.

Like the Roumanian white wheat, the Banat wheat is an early variety and resistant to winter weather.

The Roumanian red wheat (Plate XXV, Fig. 64) has a red, awned ear and a thick, stiff stalk. The grain is larger than that of other varieties and lighter in colour and of floury texture, sometimes slightly flinty. The weight of a hectolitre is less than that of white wheat. Red wheat is less extensively grown than white.

Ghirka wheat has a short thick, very stiff stem. The ear is red, of narrow insertion, with awned spikelets. The grain is red, small, flinty and of superior quality.

Ghirka wheat is generally grown as a spring crop.

Sandomir wheat (Plate XXVI, Fig. 65) has a yellowish-red stalk, thin, but fairly stiff. The ear is light red, of narrow insertion, tapering at the top, and with a short awn. The grain is yellowish-white, small, oval, and of floury texture.

Sandomir wheat is very early, and resistant to bad weather and rust. It is mostly grown in Bessarabia as a spring crop.

Arnaoute wheat (Plate XXVII, Fig. 66) has a long, reddish-yellow stalk. The ears, blueish-green when young, change to light red on maturity, and are covered with a blueish deposit. The ear is thick and square in section. The grain, is light yellow, long and pointed, flinty, thin tegument, and of very good quality.

Arnaoute wheat is in great demand on the corn markets for the manufacture of food pastes. It is grown as a spring crop, especially in Bessarabia and Dobruja.

Turkish white wheat (Plate XXVIII, Fig. 67) has a strong, long, stiff stalk, a short, reddish ear square in section, larger and denser than that of Arnaoute wheat. The awns are very long and hard, the lower part being black and the upper part yellow. The grain is large, long, pointed, flinty, very rich in protein, of very good quality and in great demand for the manufacture of flour pastes.

Ulka white wheat (Plate XXIX, Fig. 68) has a yellowish-white, thin, fragile stalk. The ear is long, of narrow insertion, awnless, and white. The grain is long and reddish-yellow, flinty, slightly concave, and with a small tuft of white hairs.

Wheat-growing. When grown on a large scale in Roumania, wheat is sown after maize; on less extensive areas it comes after peas and beans, or rape. In Bessarabia and Dobruja, where wheat is sometimes sown after sunflowers or after fallowing, it is sometimes grown several years in succession on the same field.

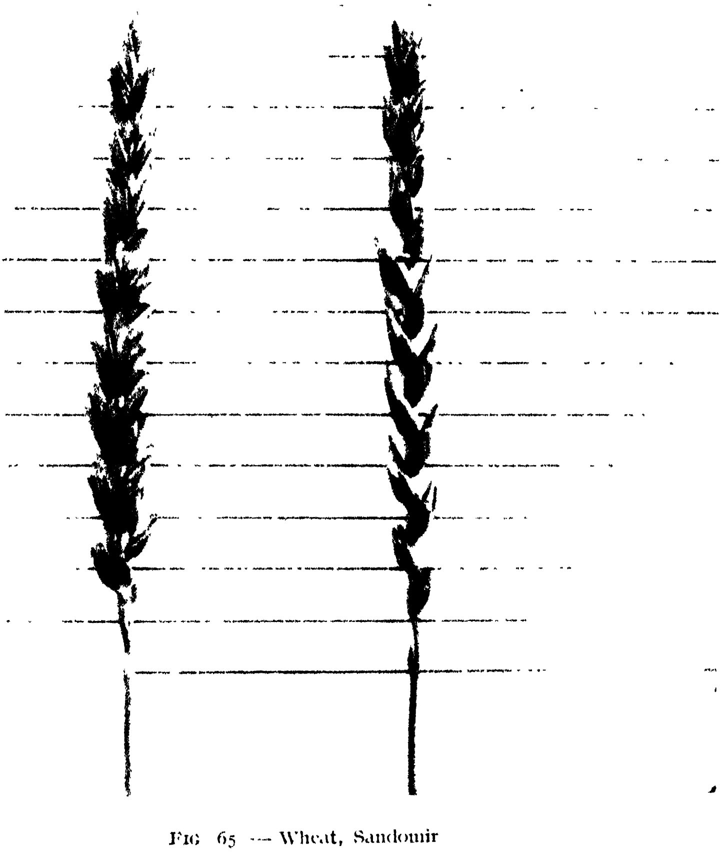

FIG 65 — Wheat, Sandomir

PLATE XXVII.

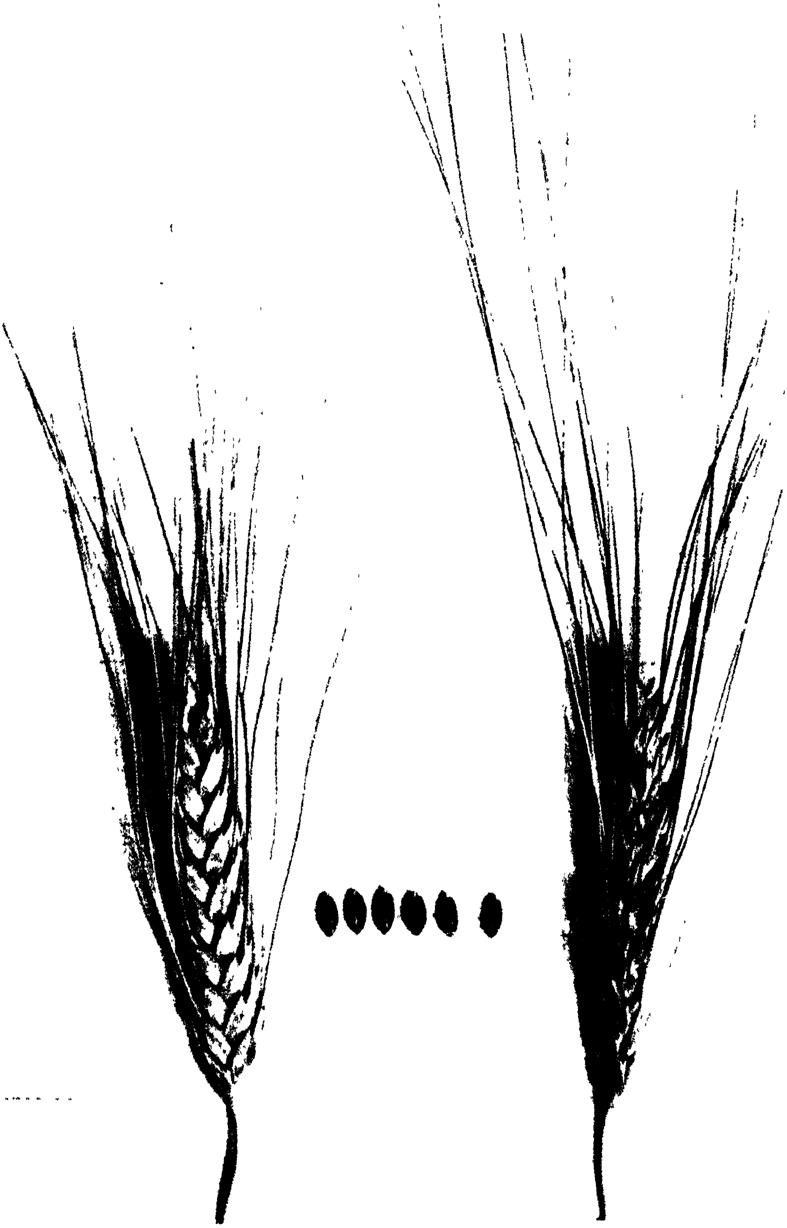

FIG. 66. — Wheat, Arnaoute

PLATE XXVIII.

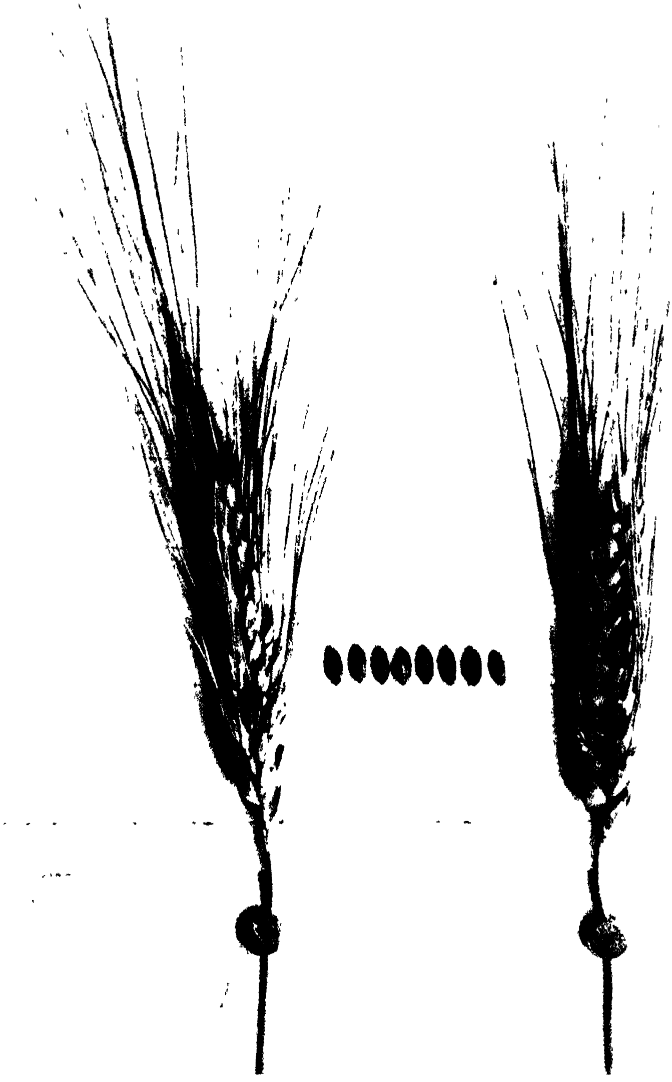

FIG. 67.—Wheat, white Turkish.

PLATE XXIX.

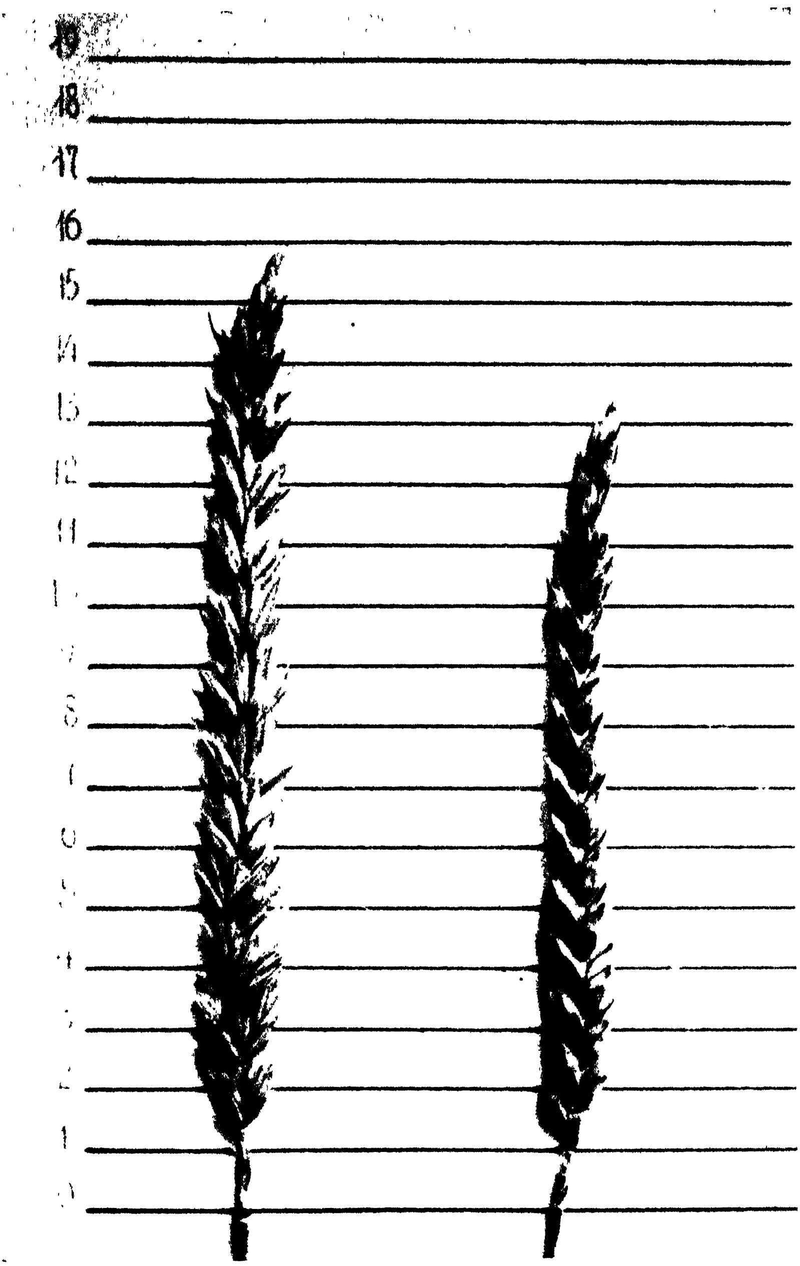

FIG. 68.—Wheat, white Ulka (winter).

When, owing to the advanced season, wheat is grown after maize, the soil is only tilled once, i. e., after the maize has been cut. If wheat is sown after a leguminous crop, rape or fallowing, the soil is ploughed twice : once, more deeply, immediately after cropping, the second time before sowing. The latter is done from the beginning of September until winter commences. Drills are used to a large extent, but the small farmers have mostly continued the broadcasting system. Spring wheat is sown immediately after the thaw sets in.

Before sowing, the soil is harrowed with an iron harrow, and after sowing, with a " bramble " harrow, an implement peculiar to Roumanian agriculture.

Sometimes wheat is sown broadcast in fields of maize before the latter is cut ; the soil is than harrowed once only, after the maize has been harvested. Wheat is sometimes sown broadcast before ploughing, which takes place immediately after sowing.

The seed is generally treated with a solution of copper sulphate as a protection against fungoid diseases, which are prevalent in Roumania, especially *Tilletia tritici*.

The quantity of seed used for sowing in drills varies from 160-180 kg., and for broadcasting, from 180-200 kg. per ha., according to the season in which it is sown.

Under a good system of farming, the soil is harrowed in April.

The wheat is harvested between 20 June and 25 July, according to the district. The scythe or sickle is used ; on large farms, however, the ordinary reaper, or the reaper-binder isemployed. Wheat reaped by hand or by the reaper, and not bound, is tied into sheaves after drying in the air for some hours, and placed in stacks, or crosswise, on the field. The shape of the ricks varies according to the district. Threshing is done with threshing-machines driven by steam-engines, animal power, or by hand. In Bessarabia, Dobruja, and some parts of Moldavia, threshing is carried out by animals trampling the wheat, which is spread out on a threshing-floor adapted for this purpose. In these districts stone rollers are sometimes used, being passed over the wheat spread out on the threshing floor.

The wheat yield in Roumania is generally small and very variable owing to the uncertainty of the climate, and especially to the frequent droughts. The quality and the weight of the hectolitre also greatly vary from one year to another. The average yield per hectare for the agricultural years 1920-1923 varied as follows:

Year	Average yield per hectare	Weight per hectolitre
1920	10.9	74.8
1921	11.1	75.6
1922	12.3	76.6
1923	12.5	77.2

The diminished yield of recent years is mostly due to drought in autumn, germination being delayed until January and February under the melting snow.

Improvements. Wheat is one of the principal exports of Roumania. It was natural therefore that efforts should have been made to improve the crop, both as regards quality and quantity. Attention has been given to increased yield and resistance to lodging, also to cryptogamic diseases, especially rust.

The work done by CIPAIANU, SANDU, ALDEA, IONESCU SISESTI, ASBIOVICI, and MUNTEANU has been mostly in connection with the selection of different pure species of Roumanian wheat, the crossing of various pure Roumanian with improved Roumanian, and with foreign species; among the latter the following have been selected: Mette's Square Head, Strube's Square Head and certain Swedish types. Among the various Roumanian types the following have been chosen: Roumanian white wheat and Banat wheat. The results obtained are considered to be very important from both a scientific and practical point of view. The comparative growth test of the different species will enable a selection to be made of the most resistant and productive.

MAIZE.

Maize is the principal food of the rural population, and is therefore cultivated over a much larger area than wheat. In 1922-1923 the area under maize was 3,404,492 ha., and yielded a total of 39,305,000 hl., an average yield of 15.1 hl. per ha. According to the statistics maize occupies the largest area under cereals. The following table shows the area and yield of the Old Kingdom before the war, and those of Great Roumania.

Old Kingdom.

Year	Thousands of hectares	Total yield in thousands of hectolitres	Hectolitres per hectare
1912	2079	31,621	17.6
1913	2147	40,407	18.8
1914	2066	36,139	17.5
1915	2107	70,452	14.5
1920	1888	35,872	19.0
1921	1861	21,221	11.4
1922	1977	22,539	11.5
1923	1966	37,154	18.9

Great Roumania.

Year	Thousands of hectares	Total yield in thousands of hectolitres	Hectolitres per hectare
1920	3205	61,512	18.1
1921	3413	37,472	10.9
1922	3403	39,305	11.5
1923	3404	57,409	16.6

Varieties. Amongst the varieties of maize grown in Roumania are the following:

Horse-tooth maize (Plate XXX, Fig. 69) is grown mostly in Wallachia, in the plain regions; it matures rather late, the growth period averaging 136 days. The stem is rather tall, attaining a height of as much as 1.70 m.-2 m; it is of average thickness, and bears 1-3 ears terminating in a point. The ear is short and covered with grain to the top, of cylindrical shape, and from 14.2-16.9 cm. in length. The proportion of grain is fairly large: 100 kg. of ears yielded 82-87 % of grain. The grain is large, light yellow and of floury structure. The weight per hectolitre is comparatively low, varying from 71-75 kg. There are also earlier species of " horse-tooth " grown in small quantities in the plain of Wallachia, some having a red, and others a white cob.

Roumanian maize (Plate XXX, Fig. 70) is only grown in the district of Prahova, Dambovita, Muscel, Ilfovet and Buzau. The growth period is 150 days. The plant grows to a height of 1.80 to 2.50 m.; the ears are short, thick and generally bear 12 rows of seed; the cob is thicker than that of the " Horse-tooth " variety: 100 kg. of ears contains 18-20 % of cob; the grain is fairly large, yellow, and floury.

Hanganesc maize (Plate XXXI, Fig. 71) is grown chiefly in the mountainous regions of Moldavia, by large growers. It is one of the most early varieties, the growth period being 120-130 days. The stalk is short, averaging 120 cm., and thin. The ears are short and thick, with 14-18 rows of seeds. The percentage of the cob is higher than that of the other varieties, being as much as 20 %. The light-coloured seeds weigh 77-87 kg. per hl. The yield is large compared with that of other varieties, averaging 30 hl. per ha.

Scorumnic maize (Plate XXXI, Fig. 72) is grown only in the mountainous regions of Wallachia; the growth period averages 135-141 days. The stem is rather tall, attaining 2-2.5 m.; there are generally one to two ears, pointed, of an average length of 18-21 cm., with 8 rows of seeds grouped two by two with spaces between. Owing to these peculiarities the percentage of seeds is smaller than that of the other varieties, varying between 71 and 82 %. The cob is white and bears 12-18 rows of seeds, which are dark yellow, wide and large. The average weight of a hectolitre is 74-75 kg. The yield per hectare varies greatly according to climatic conditions, the average being 2500-2800 kg. per hectare.

Cinquantine maize is only grown in Moldavia by the large farmers. It is an early variety, the growth period being 130-140 days. The stem is not tall, attaining 130-140 cm., and is thin. The ears are cylindrical, rather conical, and only 9-16 cm. in length. The cobs are white and thin, so that their percentage is below that of the other varieties. The seeds are small, hard, dense, pointed, light yellow or golden yellow, and 8-9 cm. long. This type of maize belongs to the small-seed varieties. The weight of a hectolitre is 81-88 kg., which is higher than that of the other varieties. As regards its food value, this type may be classed among the best varieties.

Pignoletto maize (Plate XXXII, Fig. 73) is grown only in certain districts of Wallachia, especially those of Braila, R. Sarat, Buzau, and in Moldavia. It is early, the growth period lasting 130-140 days. The thin stem reaches an average height of 150 - 180 cm. and bears 1-3 ears. The latter are thin, 11 to 13 cm. long, and tapering towards the top. The cob is white and conical. The seeds are set in straight rows, which number from 12-26; the seeds are dense and flinty; the lower ones form four horizontal rows with more pointed tops; the seeds are 8.3-9 mm. long, 5.3-7 mm. wide, and of an orange colour. The hectolitre weighs 80 kg. The yield per hectare is large, averaging 3000 kg.

Orange-coloured maize or *red maize* (Plate XXXII, Fig. 74) is classed among the semi-late varieties, the growth period lasting 135-145 days. The thin stem generally bears one ear only, rarely two.

PLATE XXX.

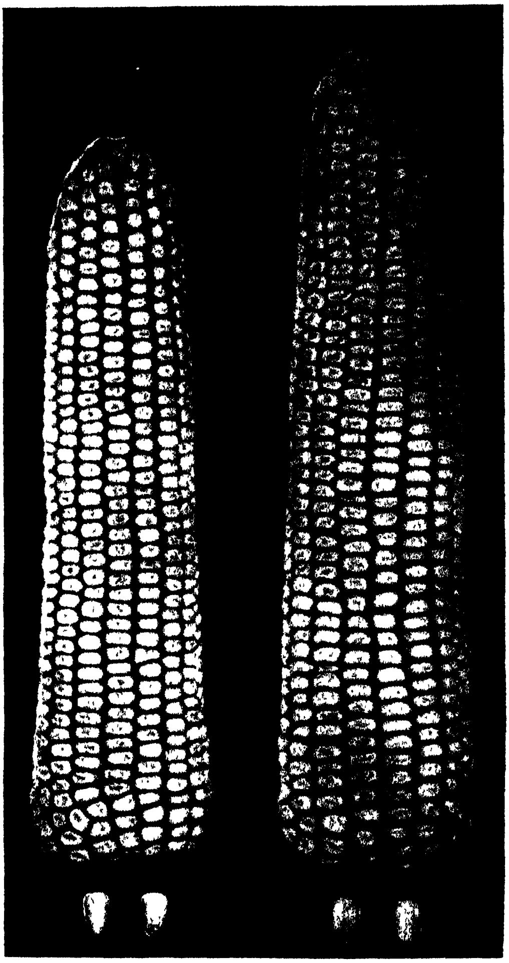

FIG. 69. — Maize, horse-tooth, after J. ENESCU.

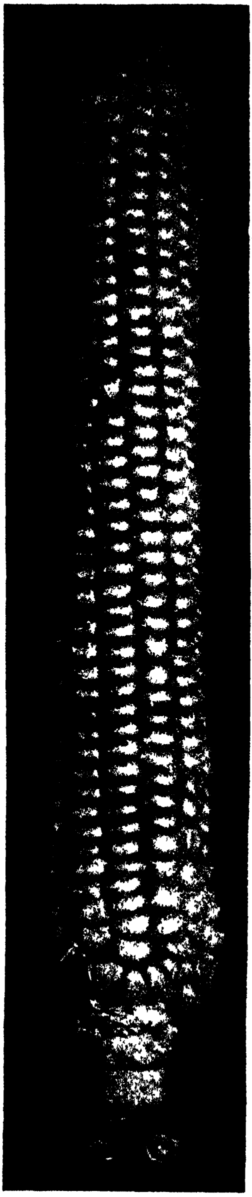

FIG. 70. — Maize, Roumanian, after J. ENESCU.

PLATE XXXI.

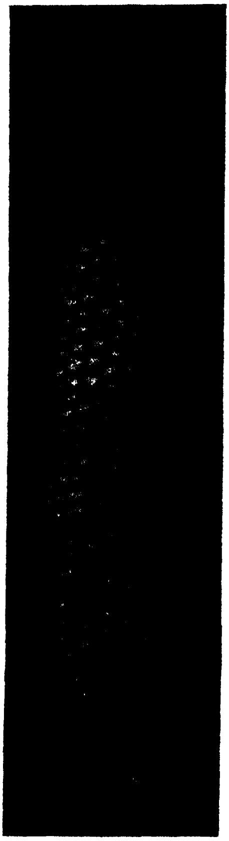

FIG. 71.—Maize, hauganesc, after J. ENESCU.

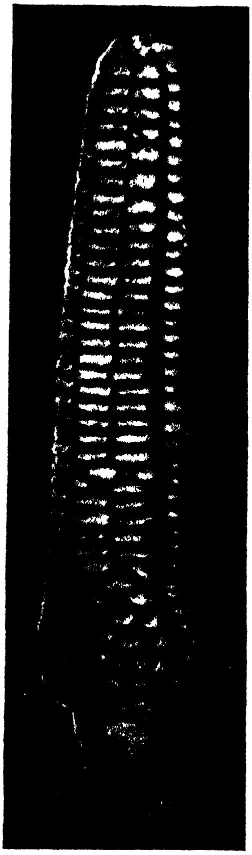

FIG. 72.—Maize, scorumnic, after J. ENESCU.

PLATE XXXII.

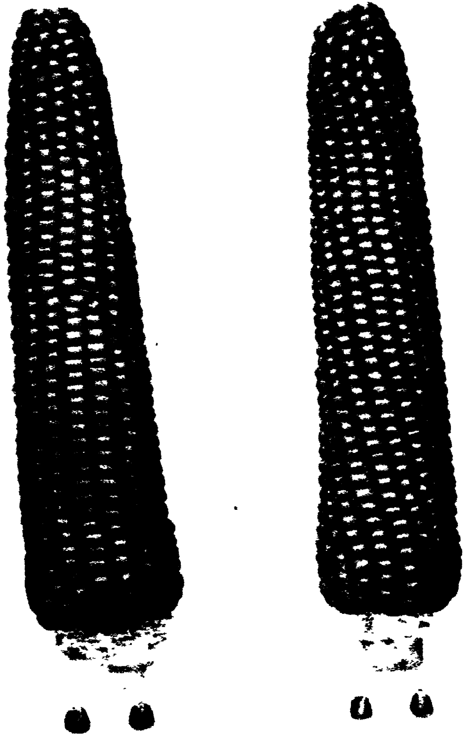

FIG. 74. — Red maize, after J. IONESCU.

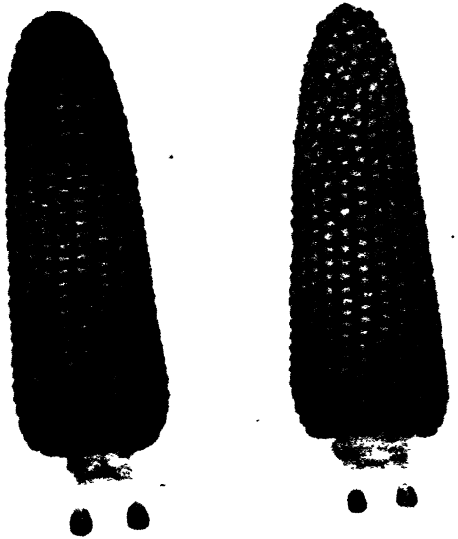

FIG. 75. — Maize, Pignoletto, after J. IONESCU.

PLATE XXXIII.

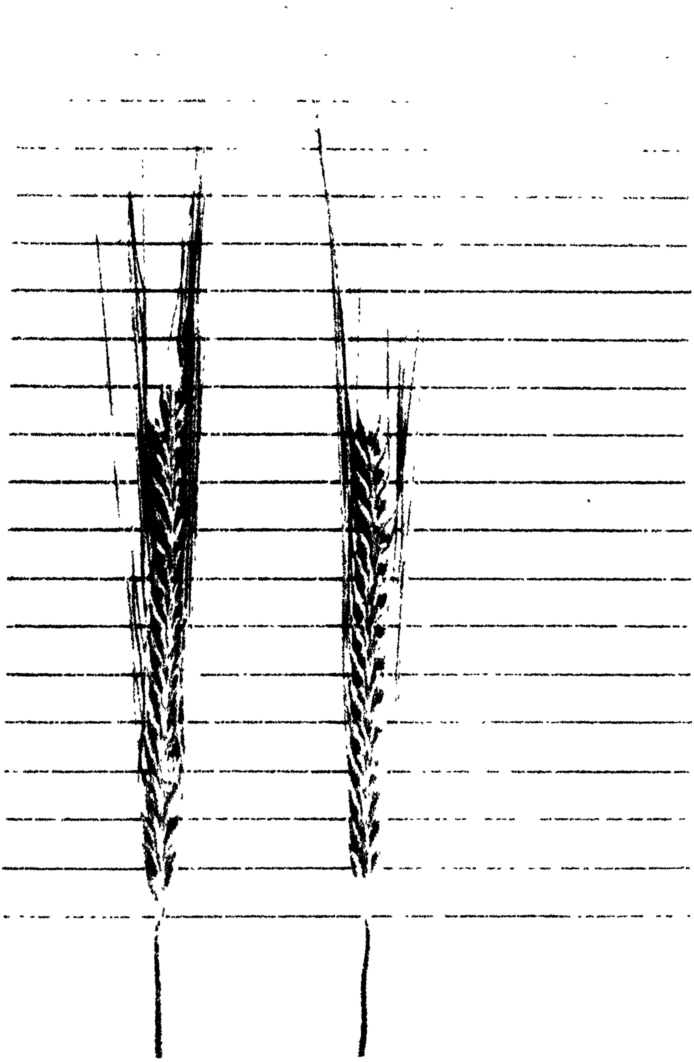

FIG. 75. — Barley, Hanna two-rowed.

The ears are 14-16 cm. long, with pointed tops, and have 12 rows of seeds. The percentage of cob is larger than that of the Pignoletto, averaging 20 %. The seeds are orange-red, wide, and flinty. The hl. weighs 79-80 kg.

Banat maize is grown mostly in the region from which it takes its name. It is a semi-late variety with a tall stem, 2-2.5 m. The ear, almost cylindrical, is 20-24 cm. long, with 12-14 straight, dense rows of seeds. The average of cob is rather high, 18 to 20 %. The seeds have twisted sides, are rounder at the top, 9-10 mm. long and 8-9 mm. wide. The hectolitre weighs 75 kg. Banat maize is rarely grown elsewhere than in Transylvania and Banat. Maize being a cleaning crop, is generally grown after the fertilisation of the soil, and precedes wheat. In most districts, and especially in Transylvania and Banat, the soil is ploughed deeply from the beginning of autumn, whereas in spring only the surface is lightly ploughed.

Sowing. — The date of sowing varies with the district. For instance, in the Wallachian plain and the hilly districts sowing may begin from the 1 April; in the mountainous regions it is delayed until May. The maize is sown in different ways according to the districts. Broadcasting is general in Moldavia. Sowing is done by hand on the untilled field, and afterwards the seed is ploughed in and the soil well harrowed.

Sowing in clumps is mostly done in Wallachia, Oltenia and Transylvania. The work is carried out with a stake or with the foot during ploughing, by the sower, who at each step makes a hole with his stake in the furrow, throws in 4 or 5 maize seeds and covers them over with his foot.

The distance between each lot of seed averages 50-70 cm., and the distance between the rows is 60-70 cm. In Transylvania and Banat, maize is sown with special machines, especially on the large and medium-sized farms. Beans or marrows are generally grown between the rows of maize.

Cultivation. — When the maize has 4-5 leaves the soil is earthed up for the first time with the spade. As this work is important the small growers pay great attention to it. The second earthing up is done in most districts in Wallachia, as well as in Moldavia and Transylvania, with a light plough, especially in those districts where labour is scarce. But the work done by the plough is rough, and is always finished off with the spade, especially the work of earthing up.

The maize harvest is from 15 September and later, according to the district. In Moldavia the entire plant is cut and made into sheaves, the ears being detached later on the threshing-floor. In some parts of Wallachia and Oltenia even the ears without leaves are pulled, the stalks being separated after the harvest.

The yield varied from 10-19 hl. per ha., according to the quality of the soil and the climatic conditions. The stems average 2500-3000 kg. per ha. ; they are used by the small farmers as a cattle-feed during the winter.

BARLEY.

The statistical data show that the cultivation of barley in Roumania is considerable.

The largest areas under barley are in Bessarabia. In Wallachia, Transylvania and some other districts where there are facilities for transport by land and water, it is only of secondary importance ; the district of Constanta for instance has a cultivated area of 102,836 ha. and produces 1,632,867 hl.

	Area in thousands of hectares	Yield in wagons	Yield per ha. in hl.
1920	1,400	147,195	10.5
1921	1,569	98,529	6.3
1922	1,727	322,622	11.8
1923	1,875	162,000	8.3

The above table shows that the area under barley is increasing from year to year, and this is explained by the fact that bar ley being exported free and without any restriction, there is a great demand for it and high prices are obtained. The small growers, especially those living in districts where there are ports, profit considerably from these concessions by the Government and have almost abandoned the growing of wheat, which is subjected to severe regulations. They have therefore replaced wheat by barley as is shown by the following comparative table.

Wheat.

District	Hectares	Total production in hl.
Constanta	21,416	334,915
Braila	39,191	401,779
Cetatea Alba	70,079	1 126,509

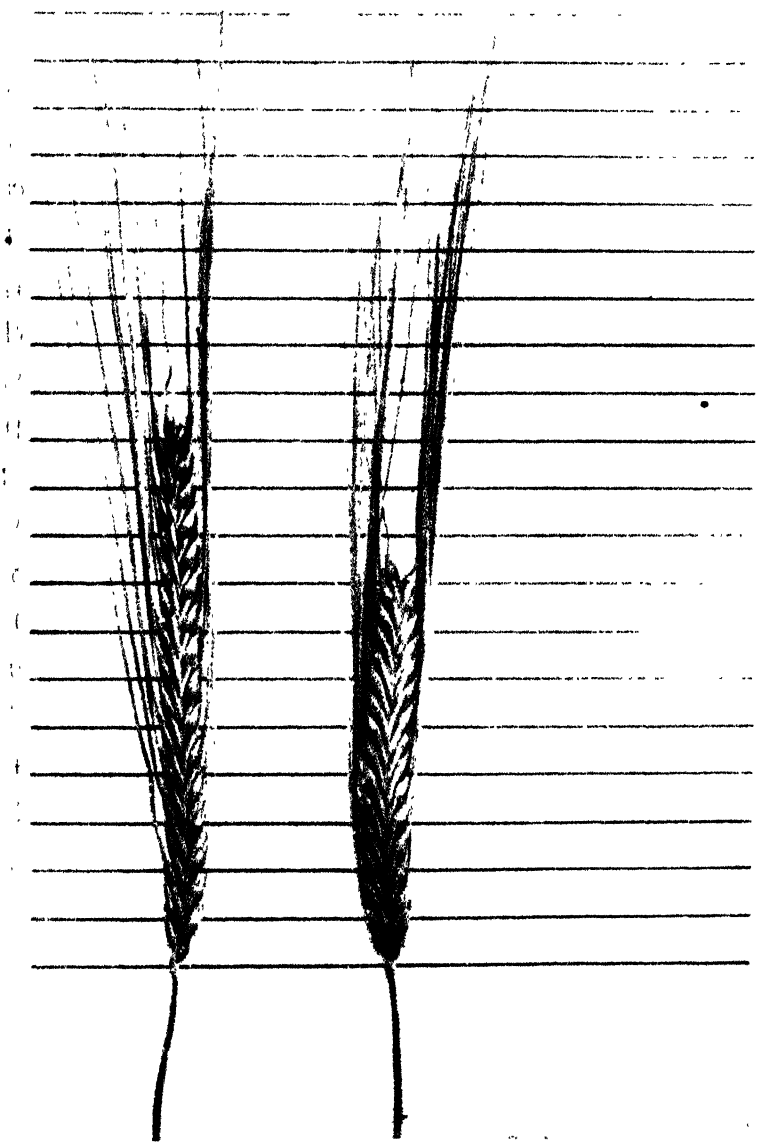

FIG. 76 — Barley, Imperial two-rowed

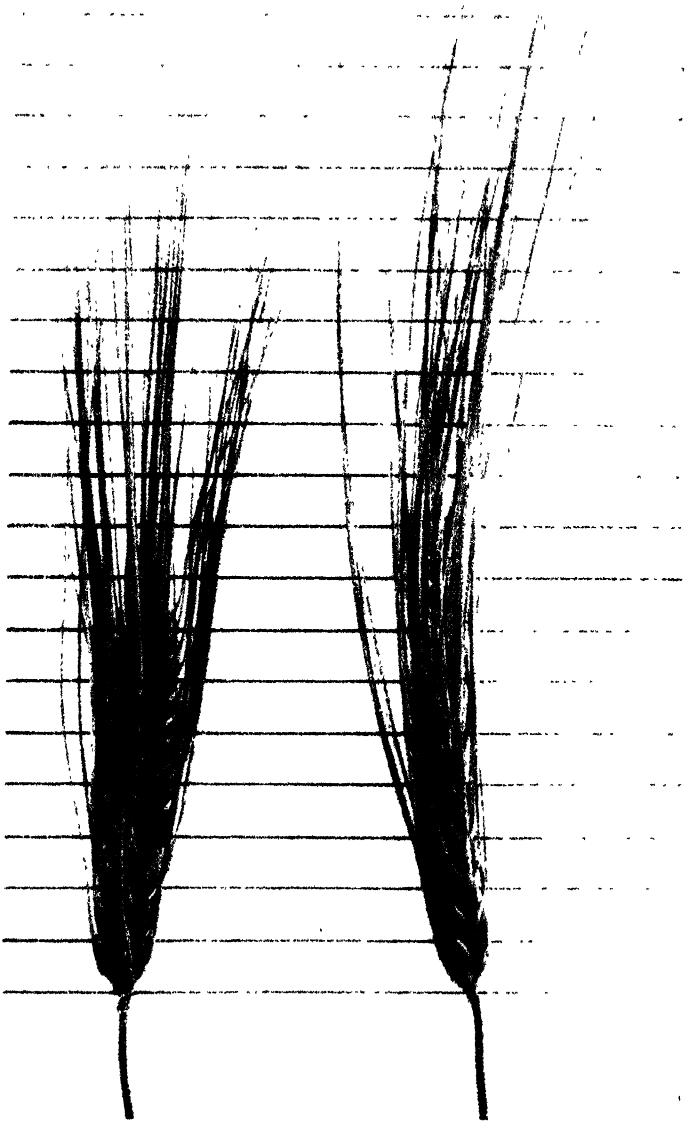

FIG 77. — Barley, Roumanian six-rowed

Barley.

District	Hectares	Total production in hl.
Constanta	183,384	1,632,867
Braila	102,836	1,155,189
Cetatea Alba	148,969	1,376,177

It is clear from this that the cultivation of barley is beginning to occupy the first place in some districts, especially on small farms.

The following species of barley are grown in Roumania :

Hordeum vulgare — common barley
" *distichon* — two-row barley.

The last-named, known as " Orzoica ", is grown mostly by the large proprietors, as it is in demand by the brewers and obtains a higher market price. This variety is grown extensively in the districts of Braila, Constanta, Tulcea and Ialomita. The area under two-row and common spring barley is larger than that under winter barley ; the following were the statistics for this crop for the years 1919-1923 :—

Year	Area	Average yield per ha.	Total production in hl.
1919-20	1,355,195	9.1	22,319,150
1920-21	1,503,705	9.7	14,603,778
1921-22	1,622,698	18.8	30,500,566
1922-23	1,783,374	11.2	20,026,770

Among the two-row species the following are grown : Chevalier, Hanna and Imperial (Plates XXXIII, XXXIV, Figs. 75 and 76), which are well acclimatised to Roumania.

Common barley is grown as a spring and winter cereal, the latter in lesser quantity than the former. The small growers distinguish between the four-row and six-row barleys belonging to this species. The six-row barley (Plate XXXV, Fig. 77) is but little grown. Growing and harvesting are carried out in the same manner as for wheat.

OATS.

Oats, like barley being exported free, their cultivation is profitable and carried on largely by the small growers. The area under oats is increasing yearly as is shown by the statistics published by the Ministry of Agriculture :—

Old Kingdom.

Year	Thousands of ha.	Total production in wagons
1912	382	30,406
1913	522	55,143
1914	427	36,739
1915	431	43,447
1920	537	59,543
1921	661	59,817
1922	752	77,604
1923	787	46,500

Great Roumania.

Year	Thousands of ha.	Total production in wagons
1920	966	99,209
1921	1,329	96,317
1922	1,333	133,645
1923	1,345	92,500

This increase in the area under oats is one of the consequences of agrarian reform ; at the same time it is also due to the fact that recent autumns have been very dry and the sowing of wheat at the proper time has not been possible.

Varieties. The variety generally grown is a native species (Plate XXXVI, Fig. 78) suitable for the Roumanian soil and climate. Among the improved foreign varieties the best adapted to Roumania are, Svalof Ligovo, Svalöf Sieges, Svalöf Goldregen. In the Timis-Torontal (Banat) district, winter oats are also grown ; they are earlier and mature sooner than spring oats. This variety is adapted to the Banat climate and gives a good quality of grain.

Oats are largely cultivated by small growers, especially those who live in the districts near the plain of the Danube, which is due to the high prices obtained at the ports.

Oats are generally sown in fields wich have been planted with

PLATE XXXVI.

Fig. [illegible]. - Roumanian oats.

PLATE XXXVII.

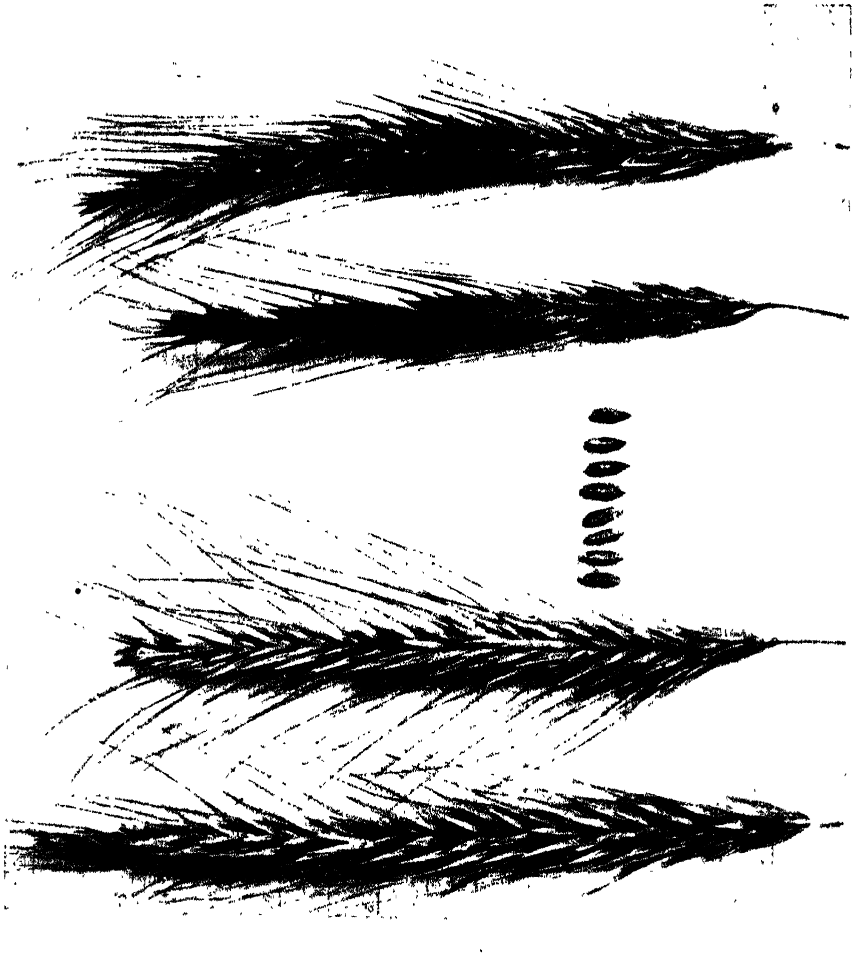

FIG. 79. — Roumanian rye

maize. The time of sowing is mostly during the early days of spring; 140 kg. per ha. are generally sown broadcast. In Transylvania, Banat, and Bucovina, however, sowing is largely done with drills, even by the small growers.

Harvesting is done in the same way as in the case of wheat.

The oat yield is generally small, and varies from one year to another owing to the frequent droughts. The average yield per ha. for the years 1920-1923 was:

Year	Average yield per ha.
1920	22.2
1921	16.6
1922	22.1
1923	16.1

RYE.

Rye is grown over a restricted area in Roumania, covering only 270,546 ha. in 1923, and yielding 22,500 wagons, an average of 8.7 hl. per ha. It is the only cereal which occupies a smaller area after the war than before.

By dividing the area under rye into districts, it will be seen that the area under this crop is more extensive where the soil is sandy, as in the districts of Dolj and Ialomita, those of Hotin, Balti and Orheiu in Bessarabia, and of Satmat and Bihor in Transylvania.

The following table gives the area and yield of rye in Roumania:

Year	Hectares	Wagons	Average per ha.
1920	315,603	23,902	7.6
1921	326,576	23,067	7.1
1922	266,523	23,384	8.7
1923	270,456	22,500	8.5

Rye is generally grown as a winter cereal. Among the varieties are: Roumanian rye (Plate XXXVII, Fig. 79), a hardy type suited to the climate and soil of the country, and Petkus rye.

Cultivation and harvesting are done in the same way as in the case of wheat.

Prof. ANASTASE MUNTEANU,
of the Academy of Agriculture, Cluj.

TWO EXPERIMENTS IN VINE-TRAINING IN LOWER LANGUEDOC.

Madame and Monsieur Egisthe SILHOL, being anxious to bequeath an estate of 62 hectares, situated at Aubord, 12 km. from Nîmes, to some institution of public welfare, chose the Agricultural Syndicate of Gard, which undertook to cultivate the property. The Syndicate appointed as Director of the Experimental Farm at Aubord, Monsieur VILLARET, an agricultural expert and himself a land owner at Beauvoisin, in the immediate neighbourhood of Aubord. M. VILLARET who is highly skilled and experienced, is very actively engaged in carrying out the work in which he takes a keen personal interest.

The estate includes buildings, some of which are in good condition, including the château, which contains nine rooms, and a cellar with a capacity of 1000 hectolitres and stables of recent construction; the remainder partly requires more or less extensive repair, or is falling into ruin.

When the Syndicate took the estate in hand at the end of 1921, it possessed 6 hectares of vines, of which half only were in good condition, and about 5 hectares of old lucerne. The rest of the land had been badly cultivated or neglected for several years.

The soil is of varying quality, from poor and pebbly alpine silt to the alluvial clay-chalk soil of the Vistre.

The Syndicate does not attempt to make profits but to carry out experiments for the general benefit.

Visitors to Aubord can already follow the experiments which are in progress and always learn something of interest.

The results are reported in a monthly publication called " Le Gard agricole " the result of the amalgamation of the " Bulletin de la Société centrale d'agriculture du Gard ", " L'Agriculteur des Cévennes ", and the " Bulletin du Syndicat agricole du Gard " and edited by the Director of the Agricultural Service at Gard, M. E. CABANE, agricultural expert.

Since 1921 the estate has been cleared, planted with vines (hybrids and French plants and various grafting stocks), sown with cereals, laid out in lucerne fields etc., A piggery, poultry-farm etc., have also been installed.

The Departmental Office of Agriculture at Gard has contributed generously towards the expenses of initial establishment and the Syndicate hopes to be able to maintain itself in a very short time, keeping always in view the principle that this farm should be specially organised for experimental work.

The first experiments in vine-training have been undertaken on this estate.

FIRST EXPERIMENTS IN A VINEYARD AT AUBORD

Monsieur E. CABANE, Director of the Agricultural Service at Gard, has contributed the following statement to a report on the work done by the District and Departmental Agricultural Offices (page 473, in the Chapter entitled " Viticulture " (Vine Growing)]

" A comparison between vine growing in vase form and training on 6 wires with long pruning and continuous surface cultivation has been carried out in the same vineyard. The yields were as follows:

Vase form	130	hl.	per	hectare	of	an	8.3° wine
Long pruning	450	"	"	"	"	"	6.5° "

" This result proves that with long pruning, 6 wire trellising and surface cultivation, there is an enormous increase in quantity but a reduction in strength It is prudent therefore to adopt this " Maroger system " on a part only of each vineyard ".

These tests were made on the 1923 harvest, and the document is authoritative, having been drawn up by M. CABANE, Director of the Agricultural Service, and certified by M. VILLARET, whose name has already been mentioned.

The following figures are deserving of attention.

I. -- On the one hand " vase " pruning yields 130 hl. of an 8.3° wine, i. e. 1.079 hectolitre degrees of alcohol.

II. — On the other hand long pruning yields 450 hl. of a 6.3° wine, or 2.925 hectolitre degrees of alcohol.

While one owner, cultivating his Aramons in vase form, obtains a yield of 100 hl. of alcohol, the other owner, adopting the Maroger method, *on a lot of the same extent and on identical soil, obtains 271 hl. of alcohol.*

These figures speak for themseves.

It should also be pointed out that the grapes were gathered at the same time in each lot, and that these lots differ only as regards cultivation and pruning.

If the fruit on the staked lots had been gathered later, the degree of alcohol would certainly have been increased. Indeed, the "vase" vines were approaching full maturity, whereas the long-pruned gropes were almost green.

In the latter case the fruit should have been left on the vine 15 or 20 days longer in order to allow the sugar to ferment as is the practice of the author on his own vineyard, on which harvesting begins when the neighbours have finished. If this practice had been followed in the above case, much more alcohol would have been obtained.

SECOND TESTS ON TWO LOTS AT LIVIÈRES, P. H. AND P. B. (1).

This test may be compared with another made on the author's estate at Livières, Calvisson (Gard) on two lots, the first called the Fanabrègue, and at least 35 years old, and the second, the Amandiers, 23 years old. Each of these lots is of about 1 hectare and they are separated from each other by a ditch. The Amandiers suffer greatly from drought, the Fanabrègue much less.

THE FANABRÈGUE. — There are good grounds for fixing the approximate age of the Fanabrègue. The bailiff, M. A. VISSOUZE, remembers that he entered on his service at Livières 34 years ago, and that his attention was especially called to two lots, the Fanabrègue and the Aire, trained on trellises.

The author was the first person in the district to attempt this method and was certainly a good deal criticised at the time. He remembers perfectly well these two lots with their stakes and trellises. The Fanabrègue bore a fixed branch attached horizontally to the trellis. It was a species of Guyot pruning and wires were fixed for cultivating in summer according to the author's ruling idea.

The Fanabrègue, then, is very old. It has many faults, as is easy to understand. This lot was planted with grafting stocks which were *riparias*, but not yet the "*gloire*" variety. Some are still to be seen in this lot. Each year a good many of the plants are replaced with *Rupestris Monticola*. In spite of all, this lot has frequently given large yields.

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(1) P. B. Low stakes (piquets bas). — P. H. High stakes (piquets hauts).

PLATE XXXVIII.

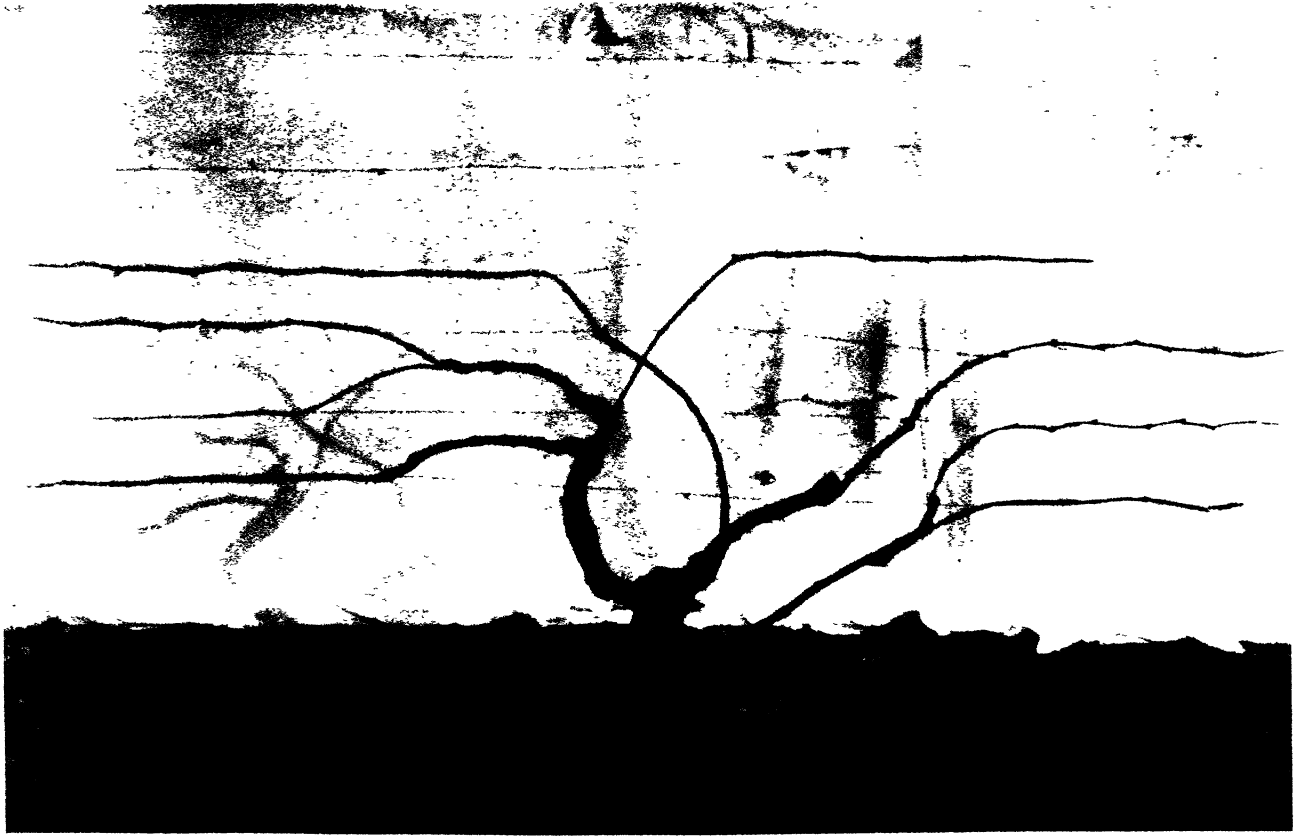

FIG. [illegible] — High stakes after pruning

PLATE XXXIX.

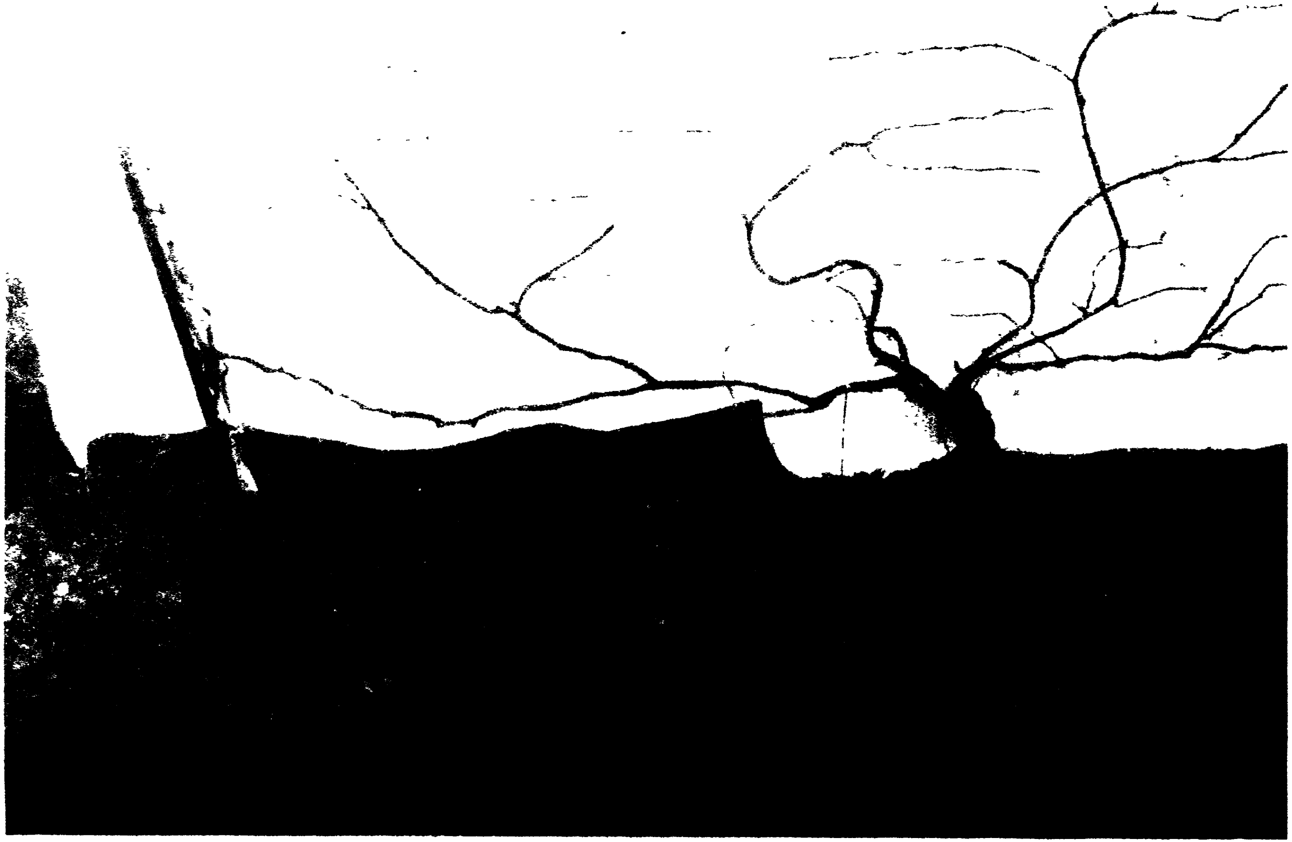

FIG. 81. — Espalier trellis after pruning

PLATE XL.

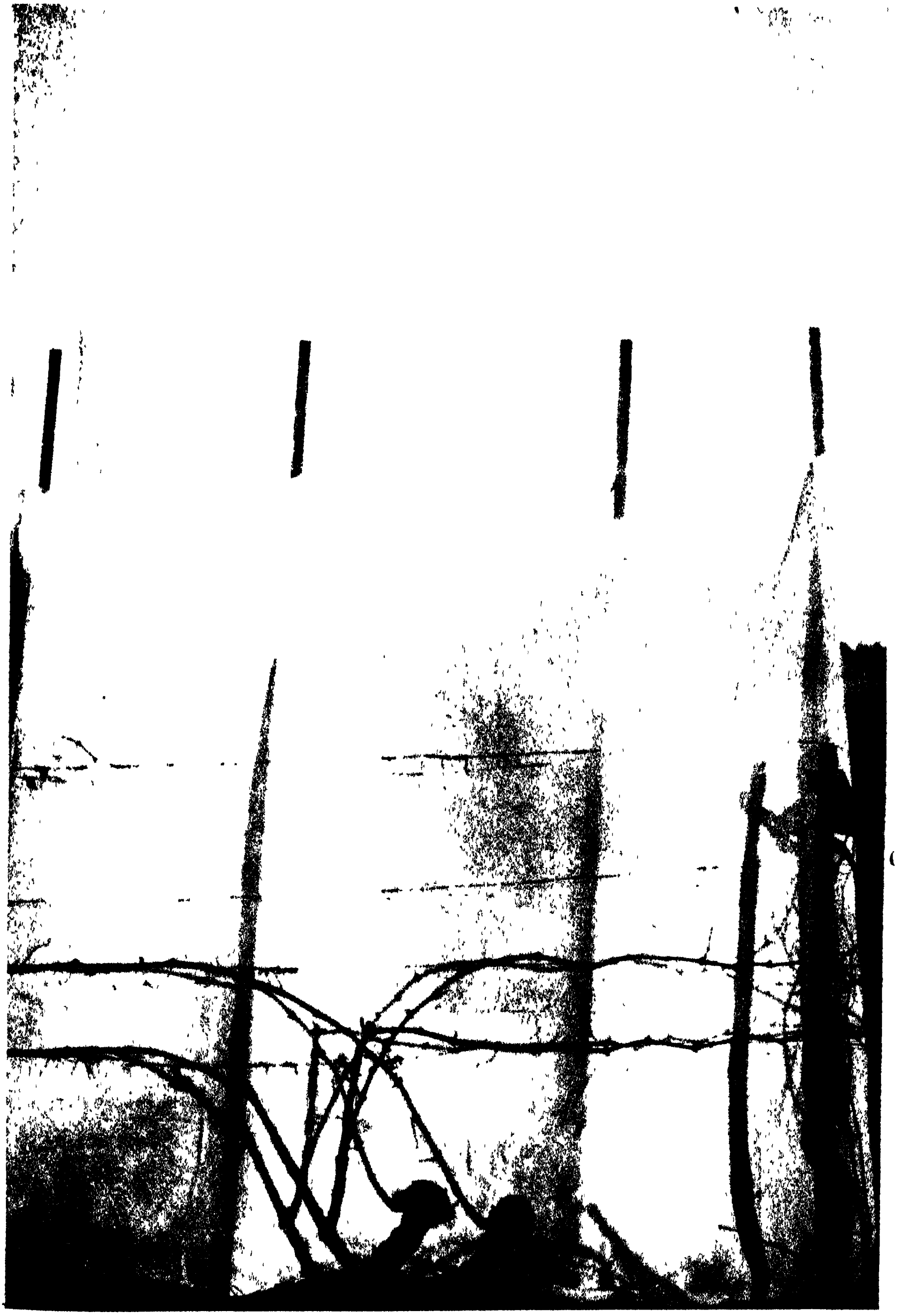

FIG. 82. Low stakes after pruning.

THE AMANDIERS. — This lot on the contrary is very regular because *Rupestris Monticola* has been planted for grafting stocks and also because it is younger.

On this property the *Rupestris* is greatly in advance of the others. Neither the *Riparia Gloire*, nor the 3309, nor many others, can be compared with it.

These two lots, the Fanabrègue and Amandiers, were, before 1918, trained on 4 wire trellises and each vine-stock bore 4 fruit-branches per year, 2 on the left and 2 on the right.

The *long pruning*, known as P. H. will first be described, and then the *short pruning*, or P. B.

Long pruning or P. H. — This is characterised by the height of the stakes, the number of fruit-branches per year, and the number of wires Plates XXXVIII and XXXIX, figs. 80 and 81). The stakes rise to a height of 1.60 metres from the ground, and the fruit branches per year, of about 1 metre, are *eight* in number for each stock. The 4 lower wires serve as a support to the fruit branches, 4 to the left and 4 to the right of the stock. The 2 upper wires are entirely reserved for intertwining.

Short pruning or P. B. — The height of the stakes above the ground is 0.90 metres ; there are only 4 wires, of which 2 support the fruit-branches to the left and 2 those to the right. (Plate XL, fig. 82). Altogether, in long pruning there are 8 fruit-branches, whereas in short pruning there are only 4; hence long pruning doubles the capacityf the stocks.

The first attempt, a very modest one, at long pruning, was carried out on 167 stocks in a corner of the Fanabrègue. These 167 stocks were tended very carefully and they had plenty of room, so that their roots were not interfered with by others.

The 1918 yield gave :

1. — P. H. 2171 kg. or 13 kg. per plant, i. e., 392 hl. per ha.

2. — P. B. 24,591 kg. or 7 kg. per plant, i. e., 211 hl. per ha.

So small a quantity as 167 plants is not very significant but is nevertheless an indication.

After this result it was decided in 1919 to make the test on a larger scale, and for this purpose the Fanabrègue and Amandiers were chosen, which are about 1 hectare each in area.

On these two lots every other row of stakes was pulled up. Of these the low were replaced by high stakes rising 1 m. 60 from the ground, and the remaining low stakes were left as before, at 0 m. 90 from the ground.

Consequently, in these two lots there are alternate rows of P. B. and P. H.

This alternation placed the two lots exactly on the same footing, except as regards the height of the stakes and its consequences.

The results are shewn in the following table :

Year	Fanabrègues		Difference	Amandiers		Difference in favour of hgih stakes.	Observations
	P.B.	P H.		P.B.	P.H.		
	Hl. per ha	Hl. per ha		Hl. per ha	Hl. per ha		
1918	210	300	180				
1919	31	100	69	31	41	10	white frost.
1920	400	432	32	172	212	40	
1921	193	262	69	185	224	39	hail.
1922	161	251	90	179	261	82	frost in Nov.
1923	235	273	38	171	202	31	
1924	122	151	29	129	147	18	
	1352	1859	507	867	1087	220	Total difference in favour of P H. = 727 hl.

This table needs some comment.

It had long since been noticed that the vine branches freely reached up to trees or any other support, while stocks which were far from any support had neither such long nor fine shoots. Bearing this in mind, the comparative test just described was made, the height of the stakes alone being varied.

In each of the Fanabrègue and Amandiers lots everything is strictly identical except the height of the wires.

The first row was left as it was, i.e. P.B., for all the old vines are still on the P.B. system with 4 wires. All the stakes in the second row were pulled up and P.H. set in place of P.B., the former rising 1 m. 60 from the ground and carrying 6 wires.

The third row is on the P.B., the fourth on the P.H. system, and so on.

It may therefore be said that everything in the two lots is exactly identical except the height of the stakes.

Even leaving out of account the first test on 167 stocks, it seems that a test carried out over 6 consecutive years on two different lots of 1 hectare each, should carry conviction.

The following are some of the results :

1 hectare was planted on the P.H. system (0.5 ha in the Amandiers and 0.5 ha in the Fanabrègue).

PLATE XLI.

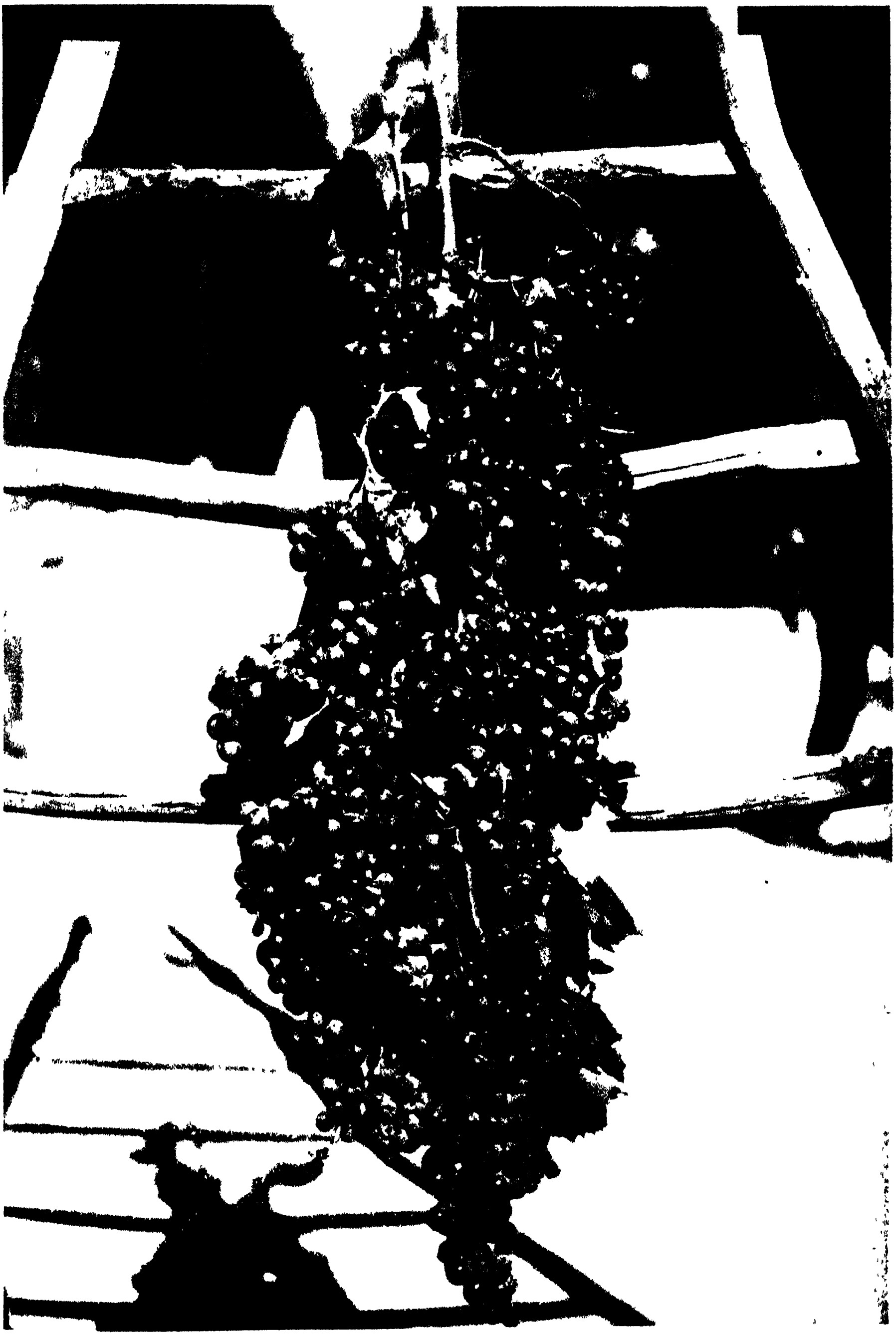

FIG. 83.—A fine bunch.

PLATE XLII.

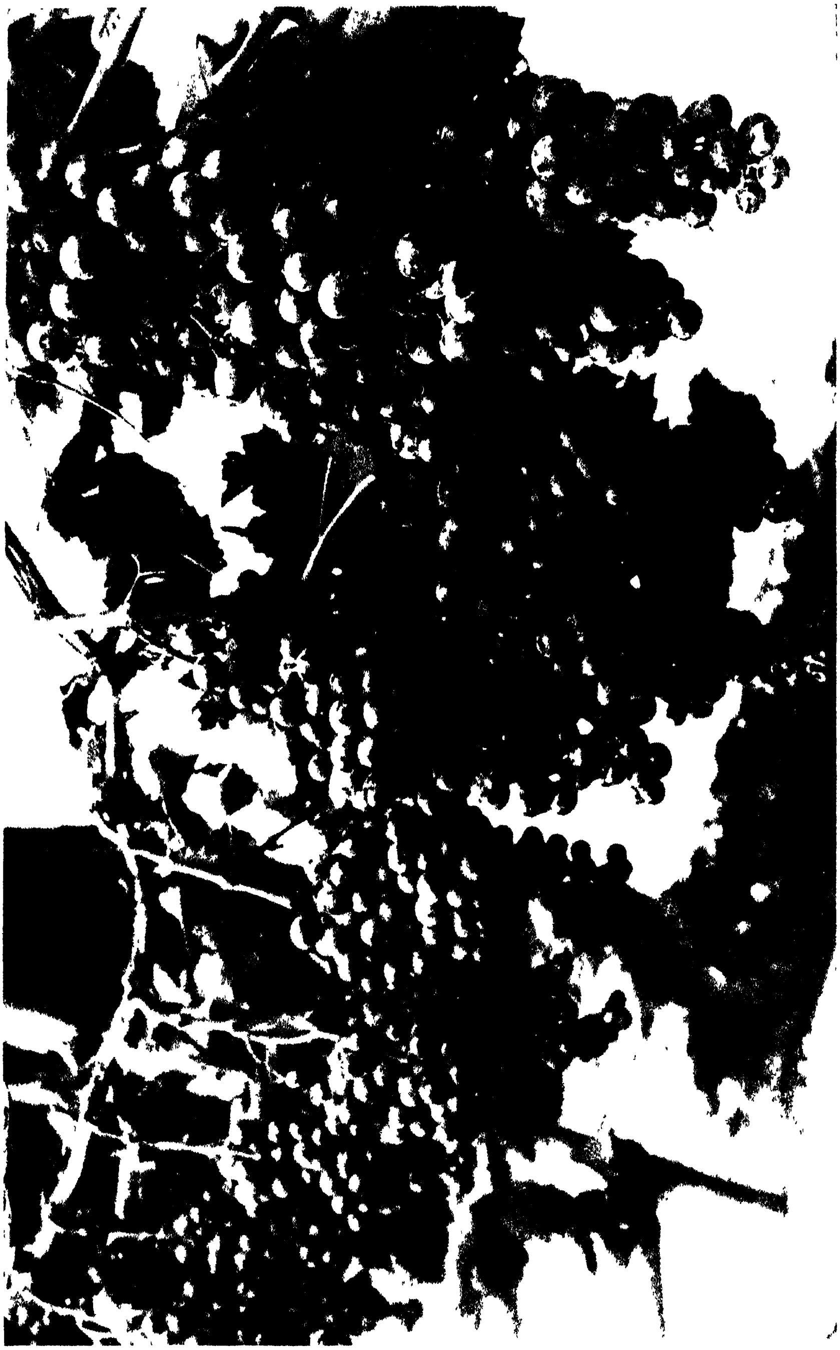

FIG. [illegible].—A single branch with fruit.

PLATE XLIII

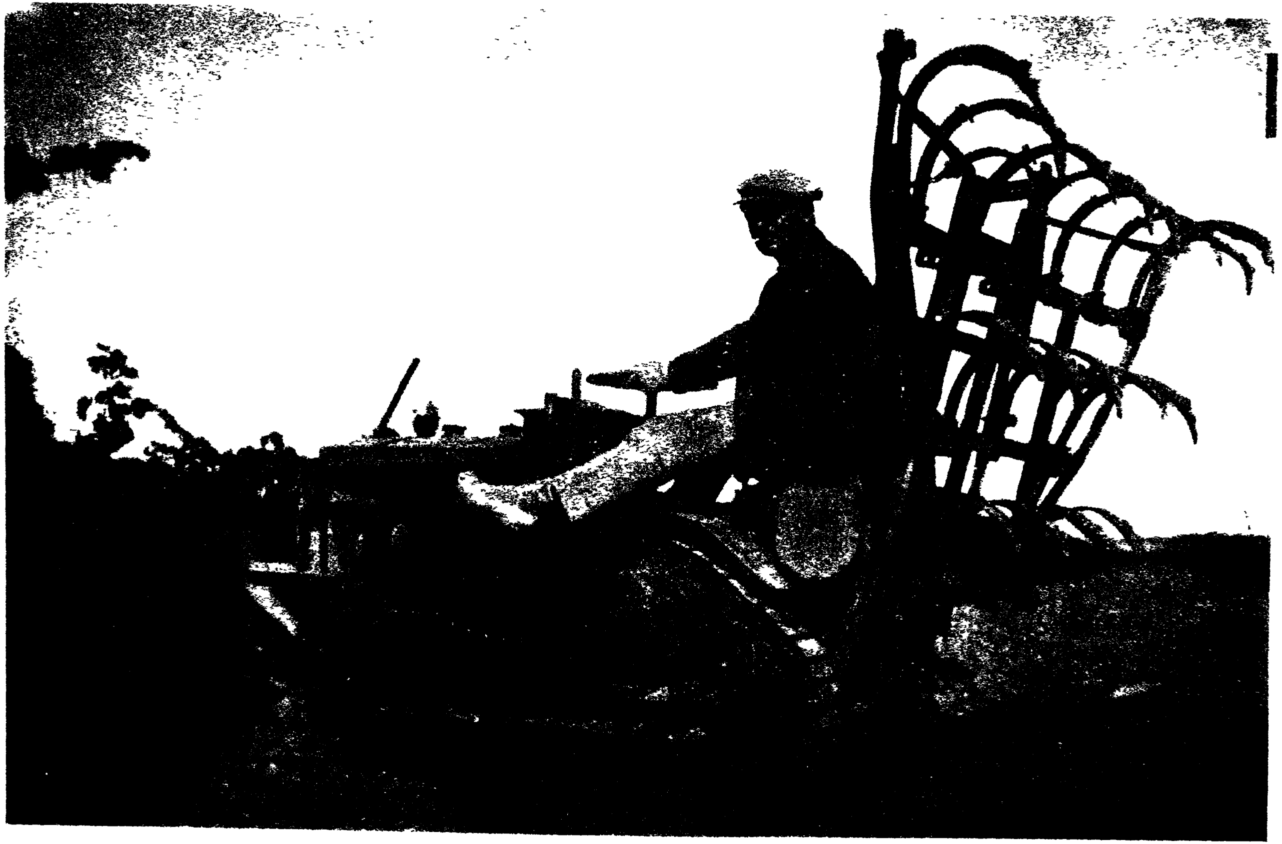

FIG. 85.—Tractor showing method employed

PLATE XLIV.

FIG. 56. — Arranged for sulphur treatment

1 hectare was planted on the P.B. system (0.5 ha in the Amandiers and 05 ha in the Fanabrègue).

In 6 years the P.H. yielded 1469 + 1087 = 2556 hl. per ha.

In 6 years the P.B. yielded 1132 + 867 = 1999 hl. per ha.

The increase in yield of the P.H. over the P.B. is 557 hl., or

$$\frac{557}{1999} = 28\ \%.$$

The total yield at Livières during these 6 years was 27,738 hectolitres.

If the whole of the vineyard had been on the P.H. system, there would have been an increase in yield of 7800 hectolitres (28 % of 27,800).

Taking 60 fcs. as the average price per hl., the owner would have been richer by 7800 × 60 = 468,000 fcs.

There would therefore have been an additional annual profit, on an average, of $\frac{468{,}000}{6} = 78{,}000$ fcs.

Or again, approximately $\frac{78{,}000}{3378} = 2300$ fcs. per hectare per year increase in gross profit.

The figures are particularly striking.

CONCLUSIONS.

1. — The vase (*gobelet*) or cup (*godet*) form of pruning and all similar forms are the least satisfactory.

2. — The P.B. (training on 4 wire trellis) is a considerable improvement on the above.

3. — The P.H. (training on 6 wire trellis) is superior to all the others because it is the most thorough.

Special note. — In these two tests, the P.B. and P.H. are of exactly the same age and receive in each lot the same cultivation, the same care and treatment.

With alternating high and low rows, there should be no difference and yet the respective yields of P.B. and P.H. show that the results are not identical. This has been observed in a particular vineyard on 2 hectares in 6 years. What is the reason ? This would appear to be a problem as yet unexplained.

It seems however that Nature, which is provident, distributes, so to speak, to each plant the daily ration necessary in view of the effort which it will put forth.

General note. — Whatever the system of pruning adopted, the paramount advantages of cultivating at all seasons should never be forgotten; these cultivations should lighten the soil to a depth of 5 cm. or at the most 6 cm.; they maintain the "drop of water" and activate the soil microbes.

⁂

In conclusion the Author considers that the attention of readers should be called to the fundamental principles of the method.

1. — The moisture should be stored and retained as long as possible.

2. — This can only be done by continual surface cultivation throughout the year.

3. — In order to cultivate the soil at any season the branches should not be allowed to run along the soil and the passages between the rows should always be kept free.

4. — Thanks to the espalier system of training, the system of pruning can be adopted which uses the long branches of a year's growth, and is the only system which can ensure large and fairly regular yields and enables the vine to utilise the supplies provided by nature.

5. — These conditions form a complete series or chain from which nothing can be taken; if a single link is missing, the result is spoilt

The characteristic conditions of well-kept vines are.

No weeds;
No clods;
No cracks;
No plough furrows.

These rules, strictly applied in the two tests here described, have led to the foregoing striking results and it is believed that other trials will also lead to the same results.

E. Maroger,

President of the Agricultural Bureau of Gard;
District Councillor of the Vine growers of France;
President af the Vine-growing Sub-Comittee
of Agriculture of Gard.

THE VINE-GROWING DISTRICTS OF RUSSIA.

There are three principal vine-growing districts in Russia, at considerable distances apart. These districts are:

(1) South European Russia (Bessarabia, Ukraine, Crimea, Don, Kuban, Stavropol, Astrakhan and Terek),

(2) Transcaucasia and

(3) Central Asia (or Turkestan).

Each of these provinces is divided into several districts according to the type of wine, each district having a different soil, different stocks and different methods of cultivation.

I. *Astrakhan* (552 hectares). — This was the first district in Russia in which vine-growing, properly so-called, was carried out in 1613, this kind of cultivation was started by Czar MICHAEL FEDOROVITCH, the first of the Romanoffs. His son, ALEXIS MICHAELOVITCH organised in 1650, the first wine-making, and the Crown vineyards in 1656, provided grapes for the Imperial table and for the first time supplied the Court at Moscow with wine. Vine-growing was further developed by PETER THE GREAT, 1700-1722, who showed his personal interest in the work while in Astrakhan during the Persian military expedition.

He appointed a French expert, POSSIETE, to take charge of the vineyards and entrusted him with the improvement of the native vine and the introduction of the European plant. The vines and cellars of the Crown prospered up to the end of the XVIIIth Century, and offered an example to the people, who started growing the vine in the country districts around Astrakhan, near the mouth of the River Volga.

After these early attempts at wine making and the improvement of the native vines the district specialized in high-quality table grapes that showed good keeping qualities in long distance travel. The cultivation of this vine has not as yet been greatly developed; by means of the R. Volga however it supplies the important cities of the North with table grapes to the extent of 3 ½ million kg. per year.

Wine production has almost entirely stopped because of the competition of better wine-producing districts. The vineyards are grouped around the town of Astrakhan.

2. *Don* (12,580 hectares). — Vineyards are chiefly found on the left bank of the R. Don, starting with the village of Schirski (Stanitza), and as far as Bognievska, on the banks of the Donietz, near its mouth at Don; they have lately been extended over the districts around Novotcherkask and Rostoff and the Don.

Special kinds of wine are made in these districts·

(1) The sparkling Trimlianskoie wine of the modern type. A foreign traveller (1852) declared these wines to be very pleasant (Hommaire). It is popular in all districts of the S. Russian plains and also with foreigners;

(2) A special kind of sweet wine made with raisins;

(3) A kind of wine made stronger by a process of freezing (vimozozki);

(4) Ordinary light table wine, sharp in flavour and refreshing, which is the most abundantly produced At the beginning of the XIXth Century, instructors from the Rhine considerably influenced the technical methods of vine-growing on the Don.

Unfortunately adulteration of the Don wines was extensively practised, and interfered with their success on the Russian market; it was only in the XXth Century that the law against wine-adulteration and the efforts of the Cossack Government of the Don and of the Ministry of Agriculture, greatly improved wine-production, which was gradually established on a foundation of suitable modern technique. The Don wine production now entered upon the right path, but it has not yet reached its highest development. The first steps have been made towards organising co-operation in wine production under the direction of specialists. Development along this line, and the law against adulteration will be the best means of securing the success of vine-growing in this province. The most favoured Don wines among Russian consumers are the sparkling types and the sweet wines containing 2.9 % of sugar and 9-11 % of alcohol.

3. *Terek* (11,825 hectares). — Two regions producing wines of very different type may be distinguished in this province; *Kizlar* where wine production is more highly developed, with very ex-

tensive vineyards which are the principal sources of wealth in the country and *Mozdok-Chelcovskain* the wine of which is quite rough and neutral (*tchikhir*), suitable for local consumption only, and not exported.

Kizlar used to export wine in considerable quantities by the Caspian Sea and the R. Volga, and its export of brandy made from vintage residues was still more important. The wine was most often produced by the addition of alcohol, as the natural wine of the region has no strength, owing to the frequent irrigation that is indispensable for the growth of its vineyards. In 1913 the amount of brandy added to Kizlar wine was fixed by law which also prohibited all adulteration.

An inferior quality of cognac, but one which is very popular in the northern provinces of the R. Volga, was produced by the Kizlar region from its own wine during recent years.

Wine making in this province is still at a very primitive stage and its organisation is only in the early stages. European stocks and technical methods of wine making are of late introduction.

The percentage of alcohol content in Terek wines is 8 to 10.

4. *Stavropol* (5,819 hectares). — The vineyards in this province lie along the banks of the Kouma river, and in the neighbourhood of the towns of Paraskovega and Ste. Croix. They are easily irrigated and produce an enormous quantity of wine of low alcoholic content (8°-10°), very sour and weak in extraction.

Vineyards cultivated without irrigation in the region of Piatigorsk have developed lately and produce an ordinary quality of table wine of average flavour, which improves after 3 or 4 years, in bottle. This district has already proved particularly suitable for the production of an excellent cognac. The sub-soil is very chalky. This quality of wine is very sour and of low alcoholic content (9-11°) and with a low extraction rate. In the Royal Family estates of this " Tempelhoff " region the production of natural cognac was started in 1908, according to a method of distillation used in the Charente and under the charge of a French expert, M. SAUVION, a native of the city of Cognac.

This cognac even when 4 to 6 years old, was of good quality but still finer after maturing for 8 to 10 years.

The first results of the new method were very encouraging, but the events of 1918 intervened and the entire cellar and stock of a million litres of brandy and alcohol for its production was destroyed. The future of brandy production in the district is very promising.

5. *Kouban* (8,376 hectares). — This province is more favourably situated for vine-growing than the above mentioned. Vine-growing was resumed by the Russians at Eisk in 1848. Vineyards have spread over the banks of the R. Kouban and between that river and the Sea of Azoff. No special quality of wine is characteristic of the region, and the peasants gradually adopted the regular technical methods. Anapa on the Black Sea is the best region in the whole province and has made a lasting name in connection with its exceptionally good white table wine, mainly extracted from Riesling grapes. It also produces a good quality of red Cabernet but it is in the white table wine, sparkling and refreshing, with a 10-12° alcohol content, good bouquet and body and matured by 4 to 5 years bottling, that the future promise of Anapa lies.

6. *Eastern shores of the Black Sea* (950 hectares). - This province which was annexed to Russia in 1829 was entirely abandoned by the Circassians in 1865. Then only were the Russian colonisers able to re-establish their vineyards which flourished up to 1918. Around Novorossiysk vineyards were established with European stocks ; there were no native vines left, all having been entirely destroyed by the Circassians.

The early pioneers were well acquainted with their business. Dr. PENTACHOUL planted the first vineyards with Crimean vines, in 1869, and his example was soon followed. The Royal Family estate " Abraou Durceau " became the centre of wine making in this province in 1872. Shortly afterwards, the Russian planters went south and new vineyards were planted as far as Sotchi, producing a good quality table wine carefully prepared according to the methods of modern technique and mainly under modern French influence.

The sparkling Abraou wine proved the suitability of the region for wine production. Table wines from Novorossiysk and Genendrix were already typical local products of excellent quality. The stocks most commonly adopted are the Riesling, the Semillon, the Aligoté and the Pinot for white wine, while the Cabernet and blue Portugais produce a satisfactory red table wine. All these various qualities have an alcoholic content of 11°-12°, are rich in colour, have a high extraction rate and are very refreshing. The bright and sparkling white wine will prevail and become the characteristic wine of this region. It can stand comparison with the Rhine wines as has been proved by frequent expert tasting of both wines together. The method of tasting was always the same; the wine samples were not labelled but simply numbered. After, both wines had been tasted and judged, notes were attached to each sample, the origin of which was then revealed and it often happened that the Abraou wines were declared to be of higher quality than the Rhine wines except in the highest grades.

7. *Crimea* (12,000 hectares). — BYONYERSKY in the XVIth Century, DUBOIS de MONTPEREUX in the XVIIth Century and PEYSSONEIL in the XVIIIth Century, bore witness to the good quality of the Crimean wines of their days.

However, after the XVIIIth Century wars, vine-growing was almost entire lyabandoned. In th 1783, the Crimea was united to Russia and vine-growing in the province once more prospered. The Russian Government encouraged and extended what remained of the Tartar vineyards. Large land owners, and more particularly Prince M. VORONTZOFF, largely developed vine cultivation, which made rapid strides after 1823. The best European stocks were introduced and were perfectly acclimatized. The Crimean vineyards soon became models to the rest of Russia and supplied other provinces with the material for establishing their own vineyards.

Development was checked by lack of experience in methods and in the selection of stocks, and the absence of specialized experts. The encouragement of the Ministry of Agriculture and shortly afterwards, the practical organisation of the wine-production on the Royal Family Estates (1889) revived the cultivation of the vine.

The Royal Family estates possessed in the Crimea, about 1914, more than 300 hectares of model vineyards and several cellars with all modern equipment. The principal Massandra cellar alone contained 40,000 hectolitres of wine in barrels and 1,000,000 litres in bottle. The Magaratch (Ministry of Agriculture) cellar and vine yards became the scientific centre of vine cultivation in Russia.

Is is clear that strong wines and liquors of the type of port, madeira, etc., with 16-18° alcoholic content, can be successfully produced from the vineyards on the southern shores of the Crimea. It can be safely affirmed that this class of wine will establish the reputation of the region for the future.

Further north and also on the sea shore, high quality table wines were produced, wines of good body and colour, high extraction with a slight but pleasant earthy taste, sound and strong, with an alcoholic content of 11-14°. Wines produced in the Valley of Katcha, Koktebel, Otouze, Alma, etc., have far less body, and are less alcoholic (9-11°).

The vine cultivation of the Crimea was very good, except in the Tartar vineyards of the valleys lying in the heart of the peninsula. The work of the local Zemstvo has been lately largely devoted to improving the vine growing methods of the population and has started the formation of vine growers co-operative unions.

The Crimea was the best developed and principal wine-producing region in Russia. Its special wines were already established and only lacked time and full experimental research to develop and definitely stabilize their characteristics.

7. *Ukraine* (20,440 hectares). — In the provinces of Taurida (the Crimea excepted), of Kherson, of Podolia and of Ekaterinoslav, vine-growing only developed about the middle of the XIXth Century, when these steppe lands fell under the influence of Russian colonists. Large land owners introduced the best European stocks and these have already produced in certain districts table wines, and especially white wines, of very good quality. These districts for the most part produce a very ordinary quality of wine, of low alcoholic content and mostly for local consumption. Here technical methods in the various processes of wine-making were very imperfect and both the local Zemstvo and the Ministry of Agriculture exerted every effort to put it on a sound foundation.

8. *Bessarabia* (66,596 hectares). — We know from both HERODOTUS and STRABO that wine-making was a prosperous industry in this country several centuries before Christ. Its wine exports reached Muscovy and Poland in the XVIIth Century. At the time of annexation to Russia in 1812 however all the vineyards were in a sad state of neglect. The Russian Government took active steps to develop vine-growing and colonisation by Greeks, Bulgars, Germans, Swiss and Russians, who took the place of the repatriated Turks, did much for its progress. The efforts of Prince M. VORONTZOFF, of which mention has been made above, were particularly successful. Large landowners introduced French, German and Hungarian vines, built large cellars and organized a sound and well equipped industry. A School of Wine-making was founded at Kischineff in 1844 and became a very important factor through the

training it gave to experts, and the practical impetus which it supplied to scientific and research work in oenology.

Vineyards increased steadily in Bessarabia, in spite of the attacks of serious diseases — such as Oidium (1852), Mildew (1884), Philloxera (1886), and in spite of dry summers and hard winters. About 1850, the province produced 480,000 hectolitres of wine; in 1870, 800 000 hl. and possessed 30,500 hectares of vines; in 1880, 60,000 hectares, and in 1897, 77,000 hectares and it was only at that date that phylloxera reduced the area under vines to 66,596 hectares.

Since 1896 more serious attention was bestowed on the cultivation of American vines and their grafting. A selection of stocks suited to Bessarabia was made, but the vineyards thus planted were slow in development owing to the poor production shown by the grafted stocks in comparison with expectation.

The best wine-producing region of Bessarabia is the Southern Akkerma district on the banks of the Dniester and at its mouth. Wines made here are of excellent quality with 10°-14° of alcohol. Second to this comes the Benderi district. The vineyards of the hills produce good wine but the plains give a poorer quality, with small alcoholic content (8-10°). The third, wine-producing region, the Ismael District, extending to the banks of the Danube, gives wine of inferior quality. There are a large number of vineyards near Kischineff and Orgyneff; here again, the vine of the hills gives good wine (both red and white) but that of the plain is of no commercial value. The best Bessarabian wines have an alcoholic content of 9-11°, are sweet with fair bouquet and distinct flavour, light bodied and quite pleasant as table wines. The more ordinary qualities form a good basis for the distillation of brandy. Both the production of cognac and the sale of the better quality Bessarabian table wines promise exceedingly well for the future.

9. *Transcaucasia* (84,175 hectares). — This province consists of Georgia, Armenia, Aberbeidra and Daguestan. Of these, Georgia is classed highest as regards wine production and is divided into three quite distinct regions: — (1) Kakhetia, most favoured of all the regions in Transcaucasia, (2) Karthalenia, (3) Imerethia.

Georgia's rich soil and very favourable climate produce a good quality wine, full bodied, strong, with high extraction and of a peculiar earthy taste, from the important native varieties of vines such as Rea-tziteli, Saperavi, Mzvanê, Borouli, Adreouli, etc. Wine-making with its primitive methods, flourished here as in all Transcaucasia, several centuries before Christ. STRABO speaks of abundant quantities of good wines here in the second century before Christ. The vine held so high a place in the country that when St. Nina introduced Christianity into Georgia in the IVth Century A. D., the cross she carried in her hand when preaching was of vine wood.

The various conquerors of the Caucasus, the Arabs (VII-VIIIth Century A. D.) the Persians (IX-XIth Century A. D.), the Tchingiss-Khan and Tamerlane (XIII-XIVth Century A. D.) and again the Persians and afterwards the Turks (XVth Century A. D.), with their continual wars effectively put a stop to all vine cultivation in the country, and it was only when Georgia was annexed to Russia (1801) and peace reigned once more over the country, that vine-growing was resumed and prospered. It was the same Prince M. VORONTZOFF, Viceroy of the Caucasus (1844), who established some twenty experimental vine nurseries and introduced the best European vines from the Crimea. But the stocks native to the country gave excellent wine and were therefore extensively cultivated.

Prince VORONTZOFF sent young Georgians and young Armenians to study vine-growing in the Magaratch School. He founded the Caucasus Agricultural Society which greatly encouraged the development of local wine-making. Moreover, the development of railways and main roads in 1871 largely assisted the industry. The Society helped the vinegrowers to control the new pests of oidium, mildew and phylloxera with suitable apparatus and sprays.

The first pioneers of European technical methods which gradually replaced the primitive methods of the native population were Count CHERENETIFF, the Princes DZORDZADZÉ and MOUCHRANSKI, etc. The earthenware and other pots used for keeping wine were replaced by barrels, as a first step.

The Royal Family Estates also began work in 1887 by purchasing several large vineyards in Kakhetia and Karthalinia. They possessed in 1914, some 450 hectares of model vineyards in Georgia, with large, up to date cellars, and used for wine-making both the native and European stocks. Results from both were encouraging; the wines produced and matured under modern conditions showed special qualities, and only required time, and further experiment for their complete development. These wines somewhat resemble strong Burgundy types, with good colour and body, brisk, rather heavy, and of high alcoholic content (10-13°).

The red Saperavi grape has already shown its capacity for producing first class table wines. The white quality (Rea-tziteli), the Cabernet and Bresiling, have also proved their value for the production of wines that can be fairly compared with French wines, especially after bottling for some 10 to 15 years.

The Karthalinia wines are milder (9-10°). The Imeritia wine has an alcohol ratio of 10° — rarely of 11°.

In Kakhetia where hail storms are frequent, the Royal Family Estates organised cannon shooting to ward off the hail showers. This system was installed at three separate stations about 20 kilometres apart and worked very successfully from 1900 to 1918. The firing apparatus (Quelin and Perras System) and its very simple arrangement proved in practice very effective, and the expense involved was far less than would have been the cost of the damage which was avoided by its use. When in 1918, owing to political events, the anti-hail firing was abandoned, the damage done to the vines by the hail was most marked and serious. The vineyards of Napereouli and the neighbourhood, a region subject to frequent hail storms were without any means of protection in 1920 and were devastated by hail on three different occasions, after having enjoyed the protection of a firing apparatus for 18 years: — Previous to the year 1900 hail storms devastated the region every two or three years or so and the value of the anti-hail firing was fully demonstrated.

The cost of this means of protection amounted to no more than 1 ½ % to 2 % of the average gross expenditure on each estate; 15 cannons sufficed for the protection of 120 hectares and a surrounding area of some 20 kilometres, when placed behind the vineyards, facing the usual onset of the storms.

Wine production in Georgia and more especially in Kakhetia gives great promise for the future. Vineyards in Imeritia and Karthalinia were attacked by phylloxera before the year 1900, and in Kakhetia, in 1913, and American stocks have begun to be used for their reconstruction.

Armenia. — The Province of Erivan produces a very strong quality of wine (11-14°) of the port type on the banks of the Arax, at Etchmiadzine and at Asrarak, and, in other districts, a milder ordinary table wine (10-12°) is made. Technical methods of production however still require improvement. The greater part of the wine produced was distilled into cognac, and brandy, as means of communication between this province and the large Russian centres of the wine trade were as yet undeveloped. Of late however, the introduction of technical methods considerably encouraged wine production. The Choustoff Firm, producers of brandies, strong wines, and table wines, were the first pioneers of European methods in vine-growing in the province.

The Erivan table grapes have a special, and quite unique-flavour.

Aberbeidzan —The Elizabetpol Province also produces delicious Handsa table grapes, a very sweet fruit, not too delicate for transport. When irrigated, these vineyards give an abundant but poor quality wine (8-11°). German colonisers however, as well as large landowners, such as FORRER, the Princes GORTCHAKOFF and Leon GALITZIN, have proved that good table wines —especially white wines — refreshing, with fair bouquet, light, and of good flavour, can be produced here.

The Kurdasir, Matrassa and Chemakha districts of the Province of Bakou also give an abundant quantity of wine which, however, has not yet been adequately improved by good cultural methods. A poor quality of cognac is extensively produced. Improvement in the methods of production must be effected in the region before the various qualities of wines produced reach any satisfactory standard.

Daguestan. — The natives of this province had long cultivated the vine, but without very marked success. PETER THE GREAT was the first to encourage wine making here, and sent a Hungarian expert to Derbente for the improvement of the methods in use. A nursery of Crimea stocks was installed at Derbente in 1840 and by the middle of the XIXth Century, there was considerable extension of the vineyards which was even more marked in 1870-1890. A Wine-making School was founded at Derbente in 1904, and there was gradual improvement both in methods and production. Experiments showed that a good quality wine with good colour and body, strong (11-15°) and showing bouquet could be produced in this district.

Turkestan (27,391 hectares). —Thi arid and thinly populated country possesses soil that irrigation enriches to a most remarkable degree. Irrigation was well organised in some of the regions in almost pre-historic times, but wars, and the Persian, Chinese, and Tartar invasions destroyed every vestige of the Tadzik (native) cultivation.

In the Samarkand, Fergana and Sir-Darya provinces, the Russians (1864-1885) found a widespread though primitive cultivation of the vine; in the other provinces, it has been completely destroyed. Under Mussulman influence, table grapes alone were produced. The native vine gave a perfect fruit (Karchinski, arteek) of delicious flavour, and easily exported. The vineyards are well irrigated and very fertile. The vines grow on the ground without supports, and, owing to the dry climate, are not subject to cryptogamic disease, while the cost of labour is insignificant. The speciality of the country is the production of raisins.

Turkestan is now the main source of supply of grapes to Russia, owing to the railway system by which it is now connected, while it is practically free from phylloxera, as its vineyards are so frequently submerged.

Wine making was successfully developed by the Russian colonisers. Large Russian firms started business at Samarkand and at Tashkend, and established wine-making on a large scale, introducing into the work modern technique as well as European stocks, for such wines as the FILATOFF, PERKOUCHINE, IVANOFF, etc. Their first attempts at making a strong wine of the port class suggested this type as the most suitable to the country. Undoubtedly the strong liqueur wines of the district give great promise, and will prove close competitors with Crimean and even European wines in Russia, especially in the North.

General conclusions. —Such were the main characteristics of the situation of each of the vine growing regions of Russia in 1914-1918.

From the statements given above it is shewn that, in this period, Russian vineyards and Russian wine-making were in process of organisation. Russian wines were just beginning to exhibit the types that are peculiar to each separate district. Modern technique was being generally introduced, and vine-growing prospered and showed marked progress, in spite of phylloxera, which was gradually spreading from one region to another. Gradually also, the population became better trained for the work, mainly through the help of French experts, Russian Enologic Schools, and the model wine-making establishments of the Apanages, and of private individuals. Russian wine-making was placed on the right path, and persevering effort, mainly influenced by French example and French tradition, was being made towards the definite development of the various excellent native wines characteristic of each district. The great Russian wine-making houses were in the forefront of the movement, and co-operation was beginning to exercise its beneficial influence among the small vineyard owners. The staff of experts was improving and their influence was being felt in the wine-making work in all the regions including the most backward. The Great War did little to weaken progress in vine-growing, though it removed many of the vineyard workers. Subsequent events have however caused a set back.

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REFERENCES.

1. Pod redaktiey M. SHEFLER, Centralnoie Upravlenie Zemledeliya i Sovietskikh Khoziaystv v sviete novoi ekonomicheskoi politiki. Isd. (Published by Narodnogo Kommissaria Zemledeliia).
2 Prof. LIASCHENKO, Ekonomicheskii rayony Yugo-Vostoka Rossii, Rostov/D 1918.
3. Sbornik statistichesko ekonomicheski svedeniy po sielskokhosiastvo Rossii. G. Upr. Z. u. Z. 1914.
4. " Ekonomicheskaia Zhisn " i Ekonomicheskaia Gazeta Moscow, 1923, 1924
3. " Nakanune " Gazeta, Berlin, 1923.
6. " Dni " Gazeta, Berlin, 1923.
7. " Rul " Gazeta, Berlin.
8. Private information from reliable sources.

METEOROLOGICAL CONDITIONS AND PLANT DISEASES.

In its early stages the study of plant diseases resolved itself into little more than a study of the parasites. Later, the study of the host plant received greater prominence, as the truth that disease is an indication of abnormal or disordered physiology became generally recognised. Still more recently has come the recognition of another truth, namely, that diseases caused by parasites are the manifestations of complex interactions of host and parasite under the influence of the conditions of a varying environment. Such conditions may be designated " environmental factors ".

No observant person who watches the incidence of plant diseases can avoid noticing the marked influence of one group of environmental factors, those included in what is rather vaguely termed the weather, on the prevalence of many of these diseases. To give only one instance, the unusual prevalence of the powdery mildews (Erysiphaceae) noticed in England in certain summers, such as that of 1921, is frequently ascribed to periods of dry, hot weather. At the same time, such a summer as that of 1921 was too dry for potato blight (*Phytophthora infestans*) to be severe in most parts of England. If these statements are true it is evident not only that disease is influenced by the weather, but also that different diseases are differently influenced by the same kind of weather.

Furthermore, if disease in any one country can vary from year to year under the influence of the annual fluctuations of the weather, we would expect to find that countries possessing different climates, that is different *average* weather conditions, would show still more marked variations in the prevalence of their plant diseases, owing to the greater amplitude of the variations between different climates than between those of the weather of any single climate.

It might be expected that comparison between the plant diseases of areas with different climates would be difficult because the host plants would not be the same. However true this may be for the wild plants, it is much less true in regard to the major cultivated crops. The latter have been subjected to long periods of artificial selection in such a way as greatly to extend their original range. Wheat and potatoes, for instance, are grown under very considerable differences in climatic conditions. Their parasites, on the other hand, have not been subjected to the same human influence, and they have had to follow the hosts as best they could. In the larger continental areas, such as the United States and India, the wheat, sorghum, maize, and potato areas are much greater than the areas in which certain of their parasites are found.

Weather and climate depend on the same set of factors -- the ordinary meteorological factors of temperature, humidity, light, wind, etc. — and if it is desired to understand the relationship between meteorology and disease, an attempt must be made to evaluate the influence of each of these factors on the interaction between host and parasite. Probably this influence is capable, in most cases, of exact evaluation, but the data are as yet somewhat scanty. Temperature, humidity, and radiation are the chief factors about which data exist, and the following discussion will be confined to them.

The most difficult case is undoubtedly the study of the influence on disease of variations in weather conditions from one year to another within the same area. These variations are of lesser amplitude and duration than those between different climates, and most frequently are not large enough to prevent the disease from appearing but merely influence its amount.

In India rust is present every year in probably every wheat field. Whether an epidemic outbreak occurs or not appears to depend entirely on the weather conditions of the year. These conditions were analysed by MORELAND (1) for 13 years in three selected districts in the mid-Gangetic Plain. He concluded that the deciding factor was the humidity of the air in January and February (the crop being sown in October and harvested about April), and that in the districts with the earliest harvest, the earlier part of this period was more important than the later. My own observations are in general agreement with these, except for the rather natural proviso that it is the humidity of the air within the crop that is of consequence. In a field at Pusa sown throughout with the same variety of wheat, rust (*Puccinia triticina* and *P. glumarum*) was severe in an area with a dense stand and almost absent towards the borders of the field where the growth was light. In the dense crop the air humidity was nearly 20 % higher, four inches above the ground than in the light crop, as tested by an experiment lasting between 7 and 8 hours on a dull day. The temperature was about 3° C. lower in the dense crop. Soil moisture determinations showed that there was much more moisture under the dense crop, especially from the 3rd to the 6th foot, and this was really the cause of the good growth, as soil moisture is the chief limiting factor in wheat growing at Pusa (2).

Another disease, which at Pusa is dependent on humidity or rather on the deposition of dew is the die-back of chillies (*Capsicum*), due to *Vermicularia Capsici* (3). This disease appears at the flowering season about the beginning of October and may do very great damage. It ceases abruptly about 4 to 6 weeks later. This is because it is dependent on the heavy dews of this period, accompanied by a moderately high temperature. Artificial inoculations only succeed in almost saturated conditions. Plants growing under shade escape, as the deposit of the dew is slight. Later on, as the temperature falls and dew is less copious, the disease ceases. Observations during six years suggest that the relative air humidity requisite to cause an outbreak of this disease during the flowering period is over 85 %. In three of these years, when it was below this figure in the second half of September, there was no disease.

Potato blight (*Phytophthora infestans*) in the Gangetic Plain is influenced by a somewhat more complex group of factors. It is usually absent, and only two outbreaks have occurred in the last 25 years. Under certain circumstances a considerable portion of the seed used is brought down from the Himalayas where, at altitudes from about 4,000 to 7,000 ft., blight is endemic. If the Plains temperature is sufficiently high, infected seed thus brought down becomes sterilized, as it is well known that *Phytophthora infestans* is easily killed by heat. In 1912 a large import of diseased seed occurred rather late in the season, which was unusually cool at sowing time (October). In late December there was much fog and cloud with a low temperature, and an epidemic was in progress in January 1913 (4). Attempts to carry the fungus in culture over the following hot weather at Pusa failed and in the fields also there was no disease next year.

In localities where potato blight is endemic the problem is much more difficult and the meteorologic conditions that govern its intensity are by no means fully understood. It is one of the cases in which a good deal is known, thanks to the work of MELHUS (5) and others, of the conditions of temperature and humidity that influence the life-history of the parasite. The optimum temperature for the germination of the spores is between 10° and 13°C. A frost sufficient to kill potato leaves will also kill the mycelium of the fungus. Its upper temperature limits are below those required to injure the tuber, as it will not survive even 4 hours at 120°F., and cannot long be kept alive in cultures maintained throughout at over 90°F. But its optimum temperature for growth is much higher than the germinative optimum, being about 24°C. Its moisture relations are not so exactly known, but like all its allies it requires a high humidity for successful germination; it cannot stand drying for long, and zoospores are formed as a rule only in drops or films of water. The period of motility of the zoospores is longer at low temperatures; they can swim for 20 hours at 5°C., but only for 1 hour at 20°C. If the meteorological factors that influence the disease acted only by influencing the parasite, we would expect to find outbreaks always occurring when a cool, damp period alternated with a warm period at a time of the year, say July, in England when there is usually some blight in most of the potato fields. The cool period would assist germination and prolong the life of the zoospores, thus aiding dissemination, while the succeeding warm period would stimulate the growth of the fungus in the tissues. If another cool, damp period followed when the new infections were in the sporing stage, we would get the process repeated in an accentuated degree, and several such oscillations would enormously multiply the attack. But it is not easy to find records of such a regular sequence of events, partly because the meteorological data are not sufficiently detailed but perhaps also partly because the influence of the weather factors on the potato plant itself have not been studied. It is known, however, that in at least certain areas in the United States an unusually cool summer is necessary for severe attacks (6). It is also almost confined to the north-east, being seldom found below 40° of N. latitude. In Europe it is prevalent north of 50°N. In all cases it is worst where the humidity is high. In localities like the Channel Islands and the west of Ireland the humidity conditions are usually suitable, and temperature is likely to be the controlling factor in most years.

Many other diseases caused by Oomycetes appear to be influenced by rather similar conditions, as most of the Peronosporaceae have similar temperature relations. In order to demonstrate the liberation of zoospores in the Phycomycetes it has been the custom in Pusa to use chilled water during the warmer parts of the year. The downy mildew of the grape, caused by ***Plasmopara viticola,*** appears to be an exception, as most observers consider that it is worst in relatively high temperatures.

It would appear that black rot of the grape vine, caused by *Guignardia Bidwellii,* is a similar case. It is stated that severe infection only occurs when there is a cold snap with rain, followed by a warmer period. Though the temperature relations of the fungus have not been worked out, so far as I know, this is very suggestive of their being similar to those just mentioned.

Another group of diseases that appears to be closely influenced by weather conditions is the powdery mildews (Erysiphaceae). It has already been mentioned that they are sometimes said to be worse in England in dry years. I have noticed the same thing in India with regard to the pea mildew, *Erysiphe Polygoni.* More exact observations are rare. LOSCH (7) examined the prevalence of apple mildew in an orchard situated on the slope of a ravine in Wurtemberg. The slope faced S. E. The upper part was severely attacked but, as one descended, the mildew decreased until at the bottom it was insignificant. The rays of the sun struck full on the upper slope. They reached lower down later in the day and, at the bottom, shade remained all the forenoon. The upper part was very hot and dry, the bottom cool and moist. No evidence was obtained as to whether the host or the parasite was most influenced, nor whether different varieties of apple would be equally affected.

Oak mildew behaves in the same manner. It has been noted (8) to be more severe in the upper levels of sloping woods, and also in exposed localities. NEGER (9) has found that it produces its conidia much more vigorously on shoots exposed to the light than on those in the shade. Exposure and sunny weather favour the disease, but the relative importance of the factors of drought and radiation have not been fully estimated.

In Italy it has been noticed that either a drying out of the soil or a sudden rise in temperature makes wheat susceptible to *Erysiphe graminis.* RIVERA (10) believes that this is due to a lessening of turgescence and is therefore a reaction of the host plant and not of the parasite. He says it is particularly marked in rich soils where the plants have a relatively restricted root development and would naturally suffer from shortage of water or excessive transpiration.

A hot sun and dry conditions are inimical to certain species of *Oidium* and epidemics are only likely to occur when there is a rapid alternation of moisture and dryness.

In India, tobacco mildew (*Erysiphe Cichoracearum*) is practically confined to shaded plants and the cereal mildew is also worse under shade (11). Most experimenters with cereal cultures kept indoors, must have noticed the greater prevalence of mildew under such conditions than in the open. More diffuse light and the absence of air currents appear to be the causes, and exposure to light and air the remedy. The same has been noticed in regard to the vine *Oidium*, amd those on strawberry and cucumber. These apparent discrepancies might disappear on more exact knowledge of the actions of the different factors. The latter have not been studied in detail as regards their effect on the host-parasite complex, but they appear to be sufficiently marked to permit of exact evaluation. It seems likely that their action on the host is of greater importance than on the parasite, contrary to what appears to be the case with the downy mildews.

All these are cases of parasites primarily of the aerial parts of the plants. If we turn to those of the roots we find rather more exact knowledge. The problem is perhaps easier, as the environment is relatively more stable.

The earliest, and still one of the most complete, studies of the influence of temperature on a soil-dwelling parasite was made by Balls in Egypt, in 1905-6, on the sore-shin disease (*Rhizoctonia Solani*) of cotton (12). The damage done by this disease is usually restricted to the first stages of development of the seedling. Once cork-formation begins damage ceases. Cotton is sown in Egypt at different times between the end of February and May. The earlier sowings may take about 12 days to appear above ground, while in the middle of April the seedlings may be up in 5 days. Growth of the cotton root increases with a rise of temperature, in an accelerated curve which ceases rather suddenly at about 37°C. The parasite — a fungus universally present in Egyptian soils — has a similar growth curve, ceasing very abruptly at about the same point, 37°C. It was determined with considerable probability, especially in the case of the fungus, that inhibition of growth at the higher temperature was due to auto-intoxication, of much the same type as the well-known staling phenomenon in bacterial cultures. The toxin is produced even at the lower temperatures, but is too slowly formed to accumulate sufficiently to inhibit growth, unless the medium is scanty or the cultures are kept for longish periods, until the temperature approaches 37°. Then it is formed more rapidly than the fungus can stand, and growth ceases. When the fungus encounters the young tissues of the cotton seedling at a temperature of, say, 20°C., these are penetrated and the hyphae pass from cell to cell, destroying the tissues before the toxin has time to accumulate sufficiently to check their growth. But at temperatures approaching 33°C. auto-intoxication is more rapid and growth is delayed. At the same time, at this temperature (33°C.), the cotton plant has its vital activities near their optimum. Hence defensive cork-formation is vigorous and the parasite is checked after producing only a small scar. At 37°C. not even a scar is produced, growth of the fungus being entirely inhibited. Thus the late sown seedlings normally escape attack, but a cold spell of even a couple of days in May will cause the death of many of them. The seasonal prevalence of this disease in Egypt is therefore practically, a purely temperature reaction, affecting chiefly the parasite.

We can now leave the discussion of the influence of seasonal variations of weather on the incidence of disease, after noting that in few cases has there been a successful attempt to evaluate the influence of the different factors exactly. When we turn to those wider and more prolonged variations that constitute different climates, we find that greater success in this direction has been achieved.

In India a rice disease of great severity occurs in part of the great rice-growing tract at the head of the Bay of Bengal. It is not due to a fungus, but to a nematode worm (*Tylenchus angustus*) (13). Injury is confined to the parts of the plant above the water in which the rice is grown, and to reach these parts the worm must leave the water and climb up the plants It is a pure ectoparasite, never entering the tissues. Experiments have proved that the worm is able to move on a dry surface, provided the relative air humidity is above some point between 90 and 95 %, probably near 93. Above this point it has the power to condense water, and it moves in the film surrounding it by a snake-like method of progression. Neither feeding nor reproduction are possible under totally immersed conditions, but only in damp air between 90 and 100 % relative humidity. Below 90 % it can neither move, nor feed, nor reproduce. Hence the disease is confined to areas of maximum air humidity during the summer and autumn months. It has been possible to correlate the meteorological data from 6 reporting stations within the affected area, with the distribution of the disease and to forecast that the greater part of the rest of India, excluding parts of the Burma delta and some of the east coast districts, is not liable to become permanently infected.

The smuts of sorghum, particularly the grain smut (*Sphacelotheca Sorghi*), annually cause danage estimated at a million sterling in western India. They are also prevalent in the Punjab and submontane districts, but are unknown in the eastern half of the Gangetic Plain. KULKARNI (14) worked out the temperature relations of this disease. Sorghum has its optimum temperature for germination at about 37°C., at which temperature and suitable moisture the seedlings will be up in two days. At 20°C. they take about twice as long, and at 16°C. about three times. The spores of *Sphacelotheca Sorghi*, however, have their germinative optimum about 20° to 25°C., and germination falls off rapidly above 30°C., giving only 1 or 2 % at 37°C. Infection is only possible during the earliest stage of seedling development. At high temperatures not only is this stage shortened, but the smut spores germinate feebly. In incubator experiments no infection occurred at 40°C., whereas at 25° there was 50 to 60 %. In western India the main crop is sown at a time when the temperature is about 21° to 27°C., and naturally suffers severely. A second crop is often sown at a period when the temperature is over 30°C., and this suffers relatively little. At Pusa, in the eastern half of the Gangetic Plain, the temperature at sowing time ranges up to 38°C., and there is no natural sorghum smut, though by properly selecting the temperature at sowing time it can be artificially produced. In a comparative experiment seed grain was mixed with spores and divided into two lots. One sown at Jacobabad with an air temperature of 36° to 40°C. gave no smut. The other sown at Poona at 25°C. gave 65 % infection.

Wheat bunt (*Tilletia tritici* and *T. levis*) in India is a similar case. It is prevalent in Kashmir and along the Punjab foot-hills, occurs in the Punjab plains, but not severely, and is unknown further east or south. Bunt spores have a low optimum for germination (between 12° and 18°C.) and usually fail to germinate above 25°. In central and eastern India the temperature at sowing time is usually above 25°, while in northwestern India the temperature at sowing time is below. In the latter case it is low enough to permit the spores to germinate and infect the seedling, but further east and south it is too high. HUNGERFORD (15), under Idaho conditions, found that the maximum degree of infection was obtained with a temperature of 9° to 12°C. and fairly high soil moisture.

Maize smut (*Ustilago Zeae*) has much the same distribution in India as bunt, but its temperature relations in that country have not been worked out. In America (16) it has been shown that the maximum for spore germination and the development of sporidia is between 36° and 38°C., so that it might be expected to be limited by high temperatures at sowing time in much the same way as sorghum smut, and its Indian distribution suggests that this is the case.

Thus there is a group of four of the major diseases of cultivated plants in India (potato blight, sorghum smut, wheat bunt, and maize smut) strictly limited in their normal distribution by the temperature relations of host and parasite, the influence on the parasite being the chief.

In the United States a great deal of information regarding the temperature and humidity relations of certain diseases has been accumulated during recent years Only a few of the more striking cases, where a correlation with regional climatic conditions has been established, need be mentioned

The seedling blight of maize and wheat caused by *Gibberella Saubinetii* is a severe disease in the United States, especially in the middle west It was noticed that the southern part of the maize belt escaped this disease, as did also the northern part of the wheat belt. The temperature relations of the disease were recently worked out (17). Wheat and maize were grown in soil held constant at eight different temperatures from 8° to 36°C. and exposed to infection, with the result that the favourable soil temperatures for the infection of wheat were found to range from 12° to 28°C., the optimum being about 24°. Maize, on the other hand, was infected from 8° to 20°C., most severely from 12° to 16°. The reaction appears to be one of the host, not of the fungus (18). Like most soil *Fusaria* the latter has a relatively high optimum in culture (24° to 28°C.). At low temperatures in maize and at high temperatures in wheat, it was found that the cell-walls of the seedling long remained in an unthickened condition, easily penetrated by the fungus. At the higher temperatures in maize and at the lower temperatures in wheat, thickened cell, walls, which resist the fungus, are rapidly formed.

The temperature relations of a good many soil-dwelling parasites have been worked out. In those attacking the potato, four species of *Fusarium* together with *Verticillium albo-atrum* have their growth optimum at about 25°, two species of *Fusarium* at 30°C. The latter two are the species that cause damage in the southern potato-growing region of the United States, *F. oxysporum* and *F. radicicola* (19). The cabbage yellows parasite, *F. conglutinans*, is one that requires a moderately high temperature to cause disease. At a soil temperature between 22° and 24°C., 97 out of 104 plants wilted, and between 10° and 16°, 1 out of 88 (20). *Fusarium Lini* infects flax chiefly between 20° and 30°C., and like the last disease its geographical distribution in America is limited accordingly (21). The tobacco wilt *Fusarium*, *F. oxysporum* var. *Nicotianal*, is the same, 28° to 31°C. being its optimum for infection (22), while little infection occurs at 15° or 34°. This limits its natural range to certain areas or to exceptionally hot seasons in other areas into which it may be introduced.

In these and many other cases the temperature relations of both host and parasite have been determined only for the underground system. Recently, however, it has been suggested that the air temperature to which the above-ground parts of the plant are exposed may be of importance. This has been established in the case of the *Fusarium* wilt of tomato (*F. Lycopersici*) (23). As in the case of the sore-shin of cotton the growth curves of the parasite and of the roots of the host are similar, the optimum being about 28°C. If the air temperature is held constant at 27° to 33°, fatal wilt develops at a soil temperature of 27° but not at 17° or 36°C. There is no external symptom of wilt if the air temperature is at 17°, no matter what the soil temperature may be, nor if the soil temperature is below 20° or above 34°, no matter what the air temperature may be, although both the host and the parasite can grow at these temperatures. Hence the disease is chiefly found, in America, in the Southern States and in England, in the hottest part of the year.

Onion smut (*Urocystis Cepulae*) is a similar case (24). According to the soil and air temperature used, onions can be grown with from 100 % to no smut as a result of inoculation. The reaction is believed to be chiefly one of the host plant. The seed will germinate over a wide range of soil temperature, from 10° to 31°C., but the best top growth is got with a soil temperature of about 20°C. Infection will occur at soil temperatures between 10° and 25°C., but little at 27°. At a soil and air temperature of 25° a great many plants will outgrow the attack, but at an air temperature even as high as 30° to 33° infection can be got if the soil temperature is kept below 25°. In outdoor plantings infection was completely inhibited when the mean soil temperature reached 29°C. and increased steadily with lower temperature. This explains the geographical distribution of the disease in the United States, where it is absent from large areas in which onions are sown when the soil temperature is high.

Even mosaic diseases show definite temperature relations. In cucumber mosaic a high soil and air temperature favour the disease and the relations have been worked out in some detail by DOOLITTLE (25). JOHNSON (26) has given similar data in regard to the influence of air temperature on several mosaic diseases.

Humidity relations have not been worked out in so many cases in the United States.

In comparing oat rust (*Puccinia coronifera*) with mildew (*Erysiphe graminis*), FROMME (27) found that he could get no infection with the rust below 80 % relative humidity, and only 6 % at 93, taking infection at saturation to be 100. With the mildew, on the other hand, he got infection at from 75 to 80 % humidity.

LAURITZIN (28) found *P. graminis* on wheat still more restricted, as he got no infection at 92 % humidity and only succeeded at from 95 to 100 %. The same was required for *Colletotrichum Lindemuthianum* on beans, and nearly as high limits, 91 to 100 % for *Ascochyta Fagopyrum.*

Except in a few marked cases, such as potato blight (where temperature plays also a great part) and black rot of the vine, there has as yet been relatively little work done on humidity in relation to regional distribution. This is partly due to the greater complexity of the apparatus required for exact work. Thus, though we may believe that humidity is an important factor in the distribution of a disease in different climatic regions (as it certainly is in regard to its intensity in a given region) there is as yet little exact proof of this.

Still less have the finer details of the humidity relations of the host-parasite complex been worked out. There is just enough known to indicate that methodical research in this direction may give results of great interest. Thus PANTANELLI (29) has shown that infection of the vine leaf by *Plasmopara* is dependent on the condition of the stomata, being possible only when these are fairly widely open. Young leaves are immune because their stomata are too narrow. So also in older leaves infection fails if the soil moisture is below 15 %, unless the air humidity is above 80 %. If the soil moisture is above 20 % the stomata open widely enough to permit infection at an air humidity above 40 %.

I have so far confined myself to the action of the individual factors on particular cases of disease. It would take too much space to examine climatic influences as a whole on the general characters of the parasitic flora of a region, such as the relative scarcity of the Erysiphaceae in the tropics. But one or two cases indicating the interest of general studies of this nature may be quoted.

In Tripoli, TROTTER (30) has made observations on the character of the fungus flora. It is a hot and dry area, ranging from a region of relatively small rainfall restricted to October to February near the coast, to a region of no, or only accidental, rain inland. Of 83 Basidiomycetes, in the wide sense, 62 are parasitic rusts and smuts, and of the whole fungus flora about 70 % are parasites He suggests that the water requirements of the fungi have determined this altogether abnormal percentage of parasites, since the latter get their water from the host plants and are independent of the climatic shortage of water. Furthermore, species with a relatively short life-history predominate, especially the Deuteromycetes. Amongst the rusts an unusual number are short-cycle forms, and the same has been found for the Alpine rusts of Switzerland, the reason in both cases being the relatively short growth period that the climate permits.

Equally interesting data may be expected from ecological studies of the parasitic flora of different regions, a subject on which very little has been done. DUFRÉNOY (8) examined from this point of view the Barèges valley on the north of the Pyrenees. He studied the influence of altitude on the parasites of a certain number of plants found at all altitudes on the valley slopes, from the bottom to 2,000 m. He found three groups. In one, the parasite was equally prevalent at all altitudes (most Ascomycetes), in another it was more severe at the lower levels or confined to them (some rusts, potato parasites), and in the third it was found chiefly at the upper levels (oak mildew and some rusts). He concluded that radiation was the most important factor in influencing the vertical distribution of the parasites. Temperature was of importance in fixing the seasonal periodicity and the amount of damage caused to the host but had little effect on the presence or absence of the parasite.

The effects of shade were studied in some detail, and the chief interest in the work is the high importance given to the intensity and actinic power of the sun's radiation in influencing leaf parasites.

The practical interest and importance of the study of the relation between meteorological conditions and disease scarcely needs emphasis. In France (31) there has been for some time in operation a system of meteorological notifications from a central station at Montpellier, fed by some 60 recording substations, of the dates on which vine diseases are likely to appear and thus when spraying or sulphuring may be necessary. The notifications are based on a knowledge of the conditions influencing germination and infection, incubation in the tissues and subsequent sporulation, and are controlled by field observations at the Station. It is possible to predict sporulation seven days in advance, which gives ample time for protective measures. In Italy a similar service is operated from Turin (32).

In Germany the Biologische Reichsanstalt in Dahlem, Berlin, has established a laboratory for meteorology and phenology and has commenced the collection of data by means of a system of report cards issued throughout the country (33). A limited number of characteristic diseases are selected, and an attempt will be made to correlate their incidence and regional distribution with the isotherms and other meteorological data and with the annual fluctuations of the seasons. A search is also being made for indicator plants which may be found to have a reaction to seasonal conditions parallel with that of the parasites. HILTNER has already claimed that he can find a strict relation between the date at which snowdrops bloom and the extent of the plague of field mice which occurs from time to time in Bavaria.

The United States Weather Bureau is carrying on a large investigation to determine the effect of current meteorological factors on the growth of vegetation. As a part of this, systematic meteorological and phenological records are being kept at a number of centres with a view to determining the critical periods in the growth of crops and in the development of injurious insects and fungous diseases. Though the data are not as yet sufficient to yield much information regarding the incidence of diseases, some interesting correlations have been obtained, such as that potato blight makes its most rapid development when the daily average temperature is about 72°F. We have already seen that the optimum temperature of the parasite for growth in the host plant is about 24°C. or 75°F.

The object of this paper, however, is rather to stress the importance of beginning at the other end —of first establishing the temperature and humidity relations of the parasite and host, singly and together, and only then, with the exact information thus gained, seeking the correlation with meteorological data.

The co-operation of the meteorological authorities will be required the moment it is sought to translate the results of such exact studies into practical application. Whether the meteorological data at present recorded are sufficient is doubtful. In India they are not, neither as regards temperature nor, still more, humidity. Even where the records are taken three times daily, a correction formula appears to be required. Several such formulae have been worked out for the mean temperature, but their application differ in different localities. For the purpose here indicated, not only the means but the duration of the daily extremes may be of the utmost importance, a low minimum, if sufficiently prolonged, being perhaps sufficient to start a parasitic attack, though it might not be revealed in the daily mean if counterbalanced by a hot day.

In this brief review many points of great interest, as, for instance, the fascinating problem of the overwintering of the cereal rusts, have been omitted. No attempt has been made to do more than give examples of various aspects of the influence of environmental factors on plant disease. Field observations on the seasonal and regional occurrence of diseases have, no doubt, a certain value, but the trend of recent work has been to show that definite conclusions cannot safely be drawn from such observations unless they are controlled and elucidated by the more exact methods of laboratory research.

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BIBLIOGRAPHY

1 MORELAND, W H, BUTLER, E J and HAYMAN, J M, "Indian Wheat Rusts" *Mem Dept of Agric, India*, Bot Ser, I, No 2, 1906

2 BUTLER, E J *Ann Report Agric Res Inst, Pusa* 1912-1913, pp 61-63, 1914

3 DASTUR, J. F "Die-back of Chillies (*Capsicum* spp) in Bihar" *Mem Dept of Agric, India*, Bot Ser, XI, No 5, 1921

4. **Dastur, J. F.** " Conditions influencing the distribution of Potato Blight in India ", *Agric Journ of India*, XII (Special Indian Science Congress number), 1917
5. **Melhus, I E**, " Germination and infection with the fungus of the late blight of Potato " *Wisconsin Agric Exper Stat*, *Res Bull* 37, 1915.
6. **Chittenden, F H** " Increasing the potato crop by spraying ". *U S. Dept of Agric Farmers' Bull*, 1349, 1923, and **Martin, W. H** " Late blight of potatoes and the Weather " *N J Agric Exper Stat Bull.*, 384, 1923
7. **Losch, H** " Eine Beobachtung uber Apfelmehltaubefall und seine Beziehung zur ortlichen Lage " *Zeitsch für Pflanzenkr*, XXXI, p 22, 1921
8. **Dufrénoy, J** " Les conditions écologiques du développment des champignons parasites " *Bull Soc Myc de France*, XXXIV, p. 8, 1918.
9 **Neger, F W** " Der Eichenmehltau (*Microsphaera Alni* [Wallr] var *quercina*) " *Naturw Zeitsch Land- u Forstwirtsch*, XIII, pp 1-30, 1915
10. **Rivera, V** " Ricerche sperimentali sulle cause predisponenti il frumento alla nebbia (*Erysiphe graminis* D C) " *Mem R Staz Pat Veg*, *Roma*, 1915, and " Cryptogamic epidemics and the environmental factors which determine them " *Intern Rev of the Science and Practice of Agric*, English Ed, N S II, 3, p 604 1924
11 **Butler, E J**, " Fungi and Disease in Plants ", pp 339, 175, 1918
12 **Balls, W L** " Physiology of a simple parasite " *Year-Book Khedevial Agric Soc*, 1905-06 Also " Temperature and Growth " *Ann of Botany*, XXII, p 557, 1908, and ' The Cotton Plant in Egypt "
13 **Butler, E J** " The Rice worm and its control " *Mem*, *Dept of Agric*, *India*, Bot Ser, X, 1, 1919
14 **Kulkarni, G S** " Smuts of jowar (Sorghum) in the Bombay Presidency " *Bull Agric Res Inst*, *Pusa*, No 78, 1918, and " Conditions influencing the distribution of grain smut (*Sphacelotheca Sorghi*) of jowar (Sorghum) in India " *Agric Journ of India*. XVII, 2, p 159, 1922
15 **Hungerford, C W** " The relation of soil moisture and soil temperature to bunt infection in wheat ' *Phytopathology*, XII, p 337, 1922
16 **Jones, E S** " Influence of temperature on the spore germination of *Ustilago Zeae* " *Journ of Agric Research*, XXIV, 7, p 593, 1923
17 **Dickson, J G** " Influence of soil temperature and moisture on the development of the seedling blight of wheat and corn caused by *Gibberella Saubinetii* " *Journ of Agric Research*, XXIII, p 837, 1923
18. **Dickson, J G**, **Eckerson, S H**, and **Link, K P** " The nature of resistance to seedling blight of cereals " *Proc Nat Acad Sci*, IX, p 434, 1923.
19 **Edson, H B** and **Shapovalov, M** " Temperature relations of certain potato-rot and wilt-producing fungi " *Journ of Agric Research*, XVIII, p 511, 1920
20 **Gilman, J C** " Cabbage yellows and the relation of temperature to its occurrence " *Ann Mo Bot Gard*, III, p 70, 1916
21. **Jones, L R** and **Tisdale, W B** " The influence of soil temperature upon the development of flax wilt ". *Phytopathology*, XII, p 409, 1922.

22. JOHNSON, J. " Fusarium-wilt of tobacco ". *Journ. of Agric. Research,* XX, p. 515, 1921.

23. CLAYTON, E. E. " The relation of temperature to the *Fusarium* wilt of the tomato ". *Amer. Journ. of Botany,* X, p. 71, 1923, and BEWLEY, W F. " Sleepy disease of the tomato ". *Ann. of Appl. Biol.,* IX, p. 116, 1922.

24. WALKER, J. C. and JONES, L. R " Relation of soil temperature and other factors to onion smut infection ". *Journ. of Agric. Research,* XXII, p. 235, 1921

25. DOOLITTLE, S. P. " Influence of temperature on the development of mosaic diseases ". *Phytopathology,* XI, p. 46, 1921.

26. JOHNSON, J. " The relation of air temperature to certain plant diseases ". *Phytopathology,* XI, p. 447 ; and " The relation of air temperature to the mosaic disease of potatoes and other plants ". *Ib.* XII, p 438.

27. FROMME, F D " The culture of cereal rusts in the greenhouse ". *Bull. Torrey Bot. Club,* XL, p 501, 1913.

28. LAURITZEN, J. I " The relation of temperature and humidity to infection by certain fungi " *Phytopathology,* IX, p. 7, 1919.

29. PANTANELLI, E " Contributi alla biologia della Peronospora della vite ". *Riv. Pat. Veg.,* X, p 51, 1920

30. TROTTER, A " Caratteri ecologici e prospetto della flora micologica della Libia ". *Nuovo Giorn Bot. Ital*, N S XXII, p 500, 1915

31. CHAPTAL, J. " Les avertissements agricoles et la phytopathologie " *Congrès de Path Végétale* (*Centenaire de Pasteur*) Strasbourg, 1923, p 71, 1923.

32. VOGLINO, R " Servizio di segnalazione degli attacchi di Plasmopara viticola nel 1921 nelle Provincie di Torino, Cuneo, Novara ". *Nuovi Ann Min Agric.,* II, p. 72 1922

33. WERTH, E. " Phänologie und Pflanzenschutz " *Zeit für Pflanzenkr*, XXXI, p. 81, 1921

AGRICULTURE IN HOLLAND.

Holland has a total area of 3 268 000 hectares of which 27.3 % is arable land, 38.2 % permanent grass-land, 3 % gardens, 7.6 % forests and 13.8 % waste land.

The remaining territory is occupied by water and banks, roads and railways, buildings and estates, and the lands immediately bordering on the dykes and marshes.

The modifications which have taken place in the course of the last 90 years will be seen from the following table:

	1833	1880	1893
	ha	ha.	ha
Arable land and gardens	803,000	916,000	989,000
Grass land .	1,093,000	1,126,000	1,249,000
Forest	169,000	223,000	250,000
Uncultivated land	907,000	712,000	450,000

The above table shows that the area of permanent grass-land is much larger than that of arable land. In 3 only out of the 11 provinces of Holland, *i. e.* Groeningen, Zeeland and Limburg, does arable land predominate.

The area of uncultivated land has decreased in recent years at an average of about 7000 ha. yearly owing to clearances and transformation into arable, grass and forest land.

AGRICULTURE.

The following table gives a summary of the various crops grown on arable land and their yield:

TABLE II. — *Areas sown, total yield and yield per ha. of the principal crops grown in 1923.*

	Cultivated area	Yield		
	ha	total		per ha
Winter wheat.	58,287	2,071,051	hl	35 5
Spring wheat	3,896	117,713	»	30 2
Rye	210,128	5,134 816	»	24 4
Winter barley	12,282	547,492	»	44 6
Spring barley	11,490	491,947	»	42 8
Oats	151,024	6,569,022	»	42 6
Buckwheat	3,077	42,852	»	13 9
Total under cereals	453,193			
Broad beans and kidney beans	17 452	505,740	hl	29 0
Peas	34,909	1,027 880	»	29 4
Dwarf beans	8,062	148,093	»	18 5
Total under legumes	60,403			
Rape seed	2 120	67,026	hl	31 6
Black mustard seed	245	4,682	»	19,1
White mustard seed	1 182	25,760	»	21 8
Caraway seed	4,076	66,179	Sacks of 50 kg	16 2
Poppy seed	3 520	3,433,390	kg	973 0
Flax	10 083	7,109	Fibre kg	0 714
		91,089	Linseed hl	9 0
Canary seed	991	19,557	»	19 7
Agricultural and horticultural seed	5 261	—	»	—
Other market crops	3,056	—	»	—
Total market crops	30 543			
Potatoes	131,757	27,287,163	hl	207
Starch potatoes	29,350	10,302 825	»	353
Sugar beets	67 497	1,720,234	(per 1000 kg)	25 5
Mangolds	35,314	—		—
Swedes and turnips	10,571	—		—
Fodder carrots	2,194	—		—
Chicory	865	15,676	(per 1000 kg)	18 1
Onions	2,957	884,538	hl	299
Other roots	919	—		—
Total under roots	281,424			

A large part of the various agricultural products is employed as cattle-feed.

This statement applies not only to clover, sown meadows and forage crops, which cover a total area of 63 500 ha. and to 48 000 ha. of turnips and other roots, but also to the 154 000 ha. of oats, which are exclusively used as cattle-feed. In addition the 210 000 ha. of rye, barley and beans are mostly converted into live-stock feeds.

The following are the principal exported agricultural products: peas, beans, various seeds, especially caraway and poppy, flax, potatoes, potato starch, sugar, onions and straw cardboard.

Though, as shown by Table I, the area of arable land has not much increased since 1880, a much higher yield is shown since that date, owing to the successful combination of practical agricultural with the knowledge of agricultural science which has been imparted to the peasant class by the public authorities through the dissemination of instruction on agricultural questions.

Production has been largely increased by the adoption of excellent methods of cultivation, the intensive employment of artificial fertilisers and the use of the most productive species and varieties of seeds and plants

This is clearly brought out in the following table (see page 388).

The average yield of wheat per ha. therefore improved as from the period from 1851-60, to the extent of about 70 %, thanks to the sowing of the productive species " Wilhelmina " wheat, obtained by Prof. Dr. N L BROCKEMS in 1901 by crossing two other varieties.

The yield of rye and oats increased 37 %, and potatoes 100 %, regard being paid to the fact that the respective areas occupied by edible and industrial potatoes are in the proportion of 131 : 29.

The intensification of agriculture, as shown above was also indicated by an important change in agricultural method, which, especially after 1880, was particularly directed towards the exportation, not only of field products as above, but equally also of live-stock products.

The decreased production of crops such as wheat, barley, field beans and rape seeds corresponds with the increased production of products for direct exportation, including potatoes (potato starch) sugar beets (sugar) and peas, and of other crops such as oats and rye, which, as converted into livestock products, are partially used in connection with exportation.

TABLE III. — *Average yield of the principal crops for each decade of the period* 1851-1920.

Crops	1911–20	1901–10	1891–900	1881–190	1871–80	1861–70	1851–60	Unit of measurement
Winter wheat	32.9	29.4	24.9	23.4	22.7	21.0	19.3	hl.
Spring wheat	32.9	31.5						
Rye	24.4	23.5	21.0	19.1	17.2	17.2	18.0	»
Winter barley	42.2	44.5	41.8	40.4	39.1	37.7	32.8	»
Spring barley	35.3	36.0	32.0	29.7	28.9	—	—	»
Oats	44.6	47.8	42.2	38.4	35.3	33.7	32.4	»
Field beans	27.3	27.1	23.8	26.1	21.3	20.1	21.3	»
Peas	25.3	24.8	23.4	21.7	19.6	22.6	17.2	»
Dwarf beans	26.0	25.1	22.3	19.7	18.0	17.9	—	»
Rape seed	26.8	28.2	24.7	23.6	21.1	20.8	18.5	»
Caraway seed	24.9	24.8	21.9	—	—	—	—	Sacks of 50 kg.
Black mustard seed	19.4	19.0	18.0	—	—	—	—	hl.
White mustard seed	20.9	23.8	20.2	—	—	—	—	»
Flax fibre	59.2	622.0	486.0	462.0	393.0	--	—	kg.
Flax linseed	9.4	9.2	8.6	9.0	8.7	—	—	hl.
Canary seed	26.4	27.1	21.5	23.7	22.1	22.2	—	»
Potatoes	220.0	176.0	181.0	153.0	125.0	136.0	120.0	»
Starch potatoes	345.0	350.0						
Sugar beets	30.5	30.4	30.1	—	—	—	—	1000 kg.
Chicory	25.9	23.2	21.6	20.8	18.8	16.6	—	»
Seed onions	308.0	291.0	—	—	—	—	—	hl.

The following table will give an idea of the development of this change in method:

TABLE IV. — *Area sown with certain crops at* 3 *different periods.*

Crops	1911–1920	1881–1890	1851–1860
	ha	ha.	ha.
Wheat	59,445	86,692	81,564
Barley	24,912	45,940	43,551
Field beans	19,255	35,438	35,739
Rape	2,767	7,655	28,658
Potatoes	175,408	144,296	95,934
Sugar beets	5,689	20,320	6,587 (in 1861-1870)
Dwarf beans	10,848	2,890	1,691
Peas	29,347	23,004	10,278
Oats	147,327	116,289	84,035
Rye	211,080	202,046	188,720

In consequence of this change and also of the considerable increase in horticultural production, much more employment has been found in agriculture than previously, and, as the products were exported, the work has been paid for by the importing countries. In view of the dense and ever increasing population of the country, this factor must be considered as of great economic importance.

STOCK-RAISING AND PREPARATION OF MILK-PRODUCTS

Cattle-breeding is the most important branch of Dutch agriculture , not only, as has already been said, is the proportion between the area of permanent grassland as compared with that of arable land as 38 2 · 27.3, but as also stated above, a large part of the soil cultivated is used for growing cattle-feeds

In view, however, of the great development in cattle-breeding these factors are not in themselves sufficient to maintain a head of livestock such as that of Holland Enormous quantities of feeds are imported from abroad and converted in Holland into meat and milk products, so that cattle-raising resembles in some respects an industry dependent for its raw material on foreign countries.

Mainly as a result of this extensive importation, it has been possible to develop the raising of livestock to the extent shown in the following table (see page 390).

As will be seen from the above figures, the increase has been mostly of cattle, swine and poultry Owing to the continual clearing of moorland, the raising of moorland sheep has been greatly reduced

The increasing numbers of sheep raised on more productive " polders " has however almost counterbalanced this decrease

Horse-breeding has shown continual progress

Dutch cattle are known throughout the world for the abundance of their milk yield. The exportation of breeding cattle is consequently very important, and in 1913, breeding cattle were exported into 16 European countries and 11 countries outside Europe.

In 1923 as many as 519 breeding societies throughout the country were carrying on breeding on scientific principles.

A large proportion of the milk-products is exported.

TABLE V. — *Head of Livestock according to the cattle census returns from* 1851-1921

Species		Average in December for the years						Average May-June for the years	
		1851–1865	1866–1870	1871 1880	1881–1890	1891–1900	1904	1914	1921
Horses { over 3 years		—	210,677	215,941	218,596	215,260	221,779	238,566	258,333
Horses { under 3 year		—	42,775	48,298	53,394	58,779	73,498	88,811	105,335
	Total	242,532	253,452	264,239	271,990	274,039	295,277	327,377	363,668
Service bulls		—	11,285	16,294	17,728	18,949	18,183	23,309	25,785
Milch cows and cows in calf		—	895,972	911,011	893,848	919 365	973,098	1,068,361	1,085,713
Butchers' beasts { cows and oxen		—	67,173	74,560	77,645	71,138	64,702	97,688	63,432
Butchers' beasts { calves		—						47,085	19,597
Other young calves		—	391,018	436,185	496,501	565,118	634,420	790,499	868,244
	Total	1,286,808	1,368,946	1,438,059	1,485,722	1,574,570	1,690,463	2 026,942	2,062,771
Lambs		—	—	—	—	237,319	218,101	405,954	315,379
Sheep grazing on moorland		—	—	—	—	220,241	148,465	113,933	64,861
Other sheep		—	—	—	—	271,407	240,219	369,149	287,971
	Total	847,628	976,136	895,826	733,169	728,967	606,785	889,036	668,211
Goats		109,972	132 180	150,196	158,312	171,842	165,497	224,231	272,298
Swine		(1) 262,817	(1) 308,635	(1) 457,527	(1) 647,287	(1) 647,287	(1) 861,840	1,259,844	1,519,245
Poultry { chickens		—	1,180,050	2,224,103	2,717,780	3,606,502	4,934,942	3,068,369	3,817,860
Poultry { hens		—						6,709,593	5,842,939
Straw and wooden hives .		—	214 834	203,914	135,895	3,733	111,270	69,406	93,637

(1) Over 2 months only

In 1923 the following milk-products, in addition to 4.5 million kg. of fresh milk, were sent into the territory of the Ruhr (Germany):

22.9 million kg. of whole milk condensed and sweetened
75.8 " " " milk, skimmed and sweetened
4.1 " " " whole milk powder
2.2 " " " skimmed milk powder,

representing a total value of 48.5 million florins, or, deducting the cost of sugar, 29.7 million florins.

Also:

23.9 million kg. of butter valued at 41.3 million florins;
62 million kg. of cheese valued at 54.2 million florins.

The total production of butter was 69.4 million kg. and of cheese 105.5 million kg.

In addition to milk-products, livestock and meat were also exported.

In 1923 the exportation of livestock was comparatively small, being 24,000 head as against 118,000 during the previous year, when Belgium and France imported large numbers of cattle for restocking; in 1923 also 9.3 million kg. of fresh meat were exported.

In Holland, at the present time, butter is mostly made at the dairies. In 1923 there were 950 dairies, of which 627 were co-operative. Cheese is still to a great extent made on the farms. In order to encourage the trade in pure butter and cheese, the Dutch producers have, with the aid of the Government, introduced a system of tests. Products thus tested are authorised to bear a Government stamp, and the export of butter and cheese not bearing this stamp is prohibited. The by-products of the butter and cheese industries (butter-milk and whey) are generally utilised as swine feeds, and are excellent for the young animals. The breeding of horned cattle and swine farming generally show a parallel development.

According to the livestock returns for 1921, there were 1,519,000 head of swine in the Country.

Basing on the total number of breeding sows, which was then 147,000 as against 227,000 in 1923, the total number of swine must at present be very large, this being explained by the fact that in 1921 the stock of swine, which during the war had fallen to an insignificant number, had not up to that time been entirely replaced. Pork is an important item of export and 335 million kg. were exported in 1923, in addition to about 72,000 live animals.

Sheep farming combined with the breeding of horned cattle is important, especially in the pasture districts of the provinces of Noord-Holland, Zuid-Holland and Friesland. In these regions the "Texel sheep" is a special favourite and thrives very well on pasture, providing both wool and meat of excellent quality.

Methods of horse-breeding have undergone an important modification within recent years; formerly the heavy carriage-horse, both on account of its strength and speed, was most common. At present the heavy draught-horse, as also bred in Belgium, is coming more and more into favour and is already extensively bred.

Dutch horse-breeders in a comparatively short time have achieved magnificent results, and have spared neither expense nor effort and have shown marked ability.

The Dutch draught-horse is already known beyond the frontier and is a favourite with buyers.

Scientific poultry-farming has assumed great importance, especially in recent years, and forms a considerable source of revenue for the small producer. The development of poultry-breeding is shown by the fact that, in addition to the eggs used for home consumption, the exports of eggs in 1923 were of the value of 12,288,000 florins.

SIZE OF FARMS.

The intensive character of the agriculture and stock-breeding in Holland is partly due to the fact that the small farm is the rule and the large farm the exception. As will appear from the agricultural returns for 1921, the small farms show a further increase in number since the previous return (1910).

By dividing the farmers into 6 classes, the following table is obtained:

	1910	1921	Increase or decrease
	ha.	ha.	%
1–5 ha.	109,620	112,607	+ 2.7
5–10 »	41,439	48,945	+ 18.1
10–20 »	30,821	34.500	+ 12.0
20–50 »	23,708	22,692	— 4.6
50–100 »	3,278	2,646	— 19.3
Over 100 »	216	250	+ 15.7
Total . . .	209,172	221,649	+ 6.0

These figures show that the number of farms of from 5 to 10 ha. and from 10 to 20 ha. has greatly increased and that this increase has been clearly at the expense of the larger farms of from 50 to 100 ha.

The increased percentage of farms of more than 100 ha. is also great, but their number, 250 is relatively very small.

This last increase is probably due to the formation of some large farms after the clearing of land.

Besides the number of farms in each of these divisions according to size, it is also important to know the area of land utilised in each of these divisions.

The following short table will provide this information:

	1910	1921	Increase or decrease
	ha.	ha.	%
1–5 ha.	256,655	274,327	+ 6.9
5–10 »	287,230	338,345	+ 17.8
10–20 »	426,508	475,039	+ 11.6
20–50 »	702,647	665,988	— 5.2
50–100 »	202,111	162,267	— 19.7
Over 100 »	34,472	41,319	+ 19.9
Total . . .	1,909,713	1,958,184	+ 2.5

This table indicates that a movement very similar to that which is shown in the previous table has taken place; it will be noticed however that the area utilised by farms of from 1 to 5 ha. has increased to a much greater extent than the number of the farms themselves. This phenomenon may be explained by a displacement in favour of the larger farms in connection with a decrease in the number of farm workers who have themselves become farmers, this being the usual objective of Dutch farm labourers. The extension of horticulture, for which the areas worked are nearly always from 1 to 5 ha., must also have had some influence on the increase of this class of farm.

There is also a connection between the size of farms in Holland and the nature of the soil. Where the soil is more difficult to till and consequently a comparatively large number of horses must be employed, the farms are generally larger; next come the pasture districts, where a minimum of labour per ha. is required.

The following small table gives the relative figures.

Average size of farms.

	1910		1921	
Marine clay	22.27	ha.	19.35	ha.
river clay.	9.46	"	8.85	"
pasture	15.95	"	14.65	"
sandy soil	7.67	"	7.59	"
peat	13.94	"	13.93	"

FORMS OF TENURE.

On comparing the agricultural returns for 1910 and 1921 it is to be noticed that during these periods ownership of land farmed has increased, while tenancy occupation has decreased. Of all those farming more than 1 ha., in 1910 50.83 %, and in 1921 56.02, were owners ; and of the area of land farmed by them, in 1910 47.17 %, and in 1921 51.89 % was their own property.

The following table shows the proportion of owned lands included under the 6 types of farms as already classified according to size.

	Total % of farms worked by owners		% of land farmed by owners out of the total area in each of the groups according to size	
	1910	1921	1910	1921
1–5 ha.	50.42	56.56	50.55	55.82
5–10 »	55.84	59.82	54.52	57.58
10–20 »	52.44	55.76	51.21	54.13
20–30 »	43.89	47.62	42.25	46.20
50–100 »	37.43	46.11	37.76	46.21
Over 100 »	63.43	64.00	66 20	67.46
Total . . .	50.83	56.02	47.17	51.89

From both these tables it is seen that freehold exceeds leasehold, and this also accounts for the fact that agriculture has become highly intensive.

CO-OPERATION.

The disadvantages and difficulties arising from a lack of working capital, the purchase of raw material (cattle-feeds and fertiliser) the conversion and sale of products, the use of costly agricultural implements, etc., have been to a great extent overcome by the formation of co-operative societies among the small farmers.

Consequently agricultural co-operation in Holland has reached a high stage of development as is shown by the following figures :

Brief summary of the commercial transactions of Local Agricultural Loan Banks, current accounts at the close of the year of the three principal Central Loan Banks.

Savings deposited up to 31 December 1923	Advances at 31 December 1923	Current accounts in 1923	
		deposits	withdrawals
Fl.	Fl	Fl.	Fl.
294,813,000	126,672,000	143,466,000	150,563,000

From an enquiry made in 1920, it appeared that the following purchases has been made during the year through the agency of co-operative societies :

chemical fertiliser, value Fl. 3,827,000 ;
cattle feeds, value Fl. 40,238,000 ;
seeds, value Fl. 1,839,000 ;
and other goods, value Fl. 1,068,000.

These co-operative purchases represent a total of Fl. 3670 per 100 ha. of arable soil, grassland and gardens. In 1923 out of 951 factories of milk-products, 627 were cooperative ; 60 to 65 % of the sugar beets are treated in co-operative sugar factories ; about 90 % of the total potato starch production is manufactured in co-operative factories, and 9 out of the 17 straw cardboard factories are co-operative.

Sales by co-operative Societies, which may perhaps be greatly extended, have already attained a notable development ; for instance, even during the unfavourable year 1923, the turnover of one co-operative society alone, that of Frise, for the exportation of milk products, was Fl. 23,000,000, while auction sales of vegetables and fruit realised Fl. 53,000,000.

The co-operative form of insurance has been largely adopted, as is shown by two examples ; in 1923, horses and cattle alone were insured for a sum of Fl. 133 millions on the mutual system, while mutual insurance against hail rose to Fl. 52 millions.

Where the small farmers are unable to procure expensive agricultural machines, or where such machines are too seldom used on the farms to be economically advantageous, they must to an ever increasing extent procure them for use in common and at the common expense.

HORTICULTURE.

Horticulture holds an important place alongside of agriculture and cattle-breeding.

The climate, soil conditions, rainfall, the numerous canals and navigable rivers which provide an easy and cheap means of transport to the various centres, are factors which help to make horticulture in Holland a profitable concern.

The geographical position of Holland, between countries such as Germany, Belgium and England with their dense industrial populations, also contributes to render Holland the market garden of a part of Western Europe.

Employers and workers, well qualified by knowledge and experience, have been able to bring horticulture to a high state of perfection, while the Dutch commercial spirit has always endeavoured to ascertain the requirements of buyers, and the growers, for their part, have made every effort to conform to these requirements.

Market-gardening, fruit growing, nursery gardening and floriculture, in which the well known bulb industry is of great importance, are among the principal branches of Dutch horticulture, followed by the production of vegetable and flower seeds.

The chief markets for vegetables and fruit, in addition to those grown for home consumption, are Germany and England. Hothouse products, fruit and ornamental trees and shrubs are exported to various countries in Europe and beyond.

The same applies to cut flowers and plants, while flower-bulbs are sent all over the world.

Horticulture has become highly intensive. Whole regions, especially in the province of Zuid-Holland, are given over to culture under glass; in many cases box-culture is practised, so that throughout the greater part of the year fresh flowers, vegetables and grapes may be obtained. As regards plant cultivation the greatest possible care is taken to prevent and control plant diseases. The horticultural products therefore are the result of infinite care and work and, in view of the density of the population of Holland, must be considered as of great importance to the Country.

Though these products are very extensively used for home consumption, their exportation is also of great importance.

Exportation fell off considerably in 1923 owing to the fact that Germany at that time bought less. The extent of this decrease is shown by the fact that during the first 8 months of 1924, when Germany again appeared on the market, the value of the exportation of fresh vegetables was Fl 11,880,000 as against Fl. 32,260,000 for the corresponding period of 1923. The values of the exportation of fresh fruit during the same periods were respectively Fl. 2,593,000 and Fl. 6,486,000. The total value of the exportations during this period therefore is, in the case of vegetables 272 %, and in the case of fruit 242 % of that for the same period in 1923.

During the unfavourable year 1923 the export value of horticultural products was:

	Fl
fresh vegetables	18,595,000
fresh fruit	5,085,000
flower bulbs	26,383,000
cut flowers and stems	534,000
hot-house products	4,525,000
Total	55,122,000

IMPORTANCE OF FOREIGN COUNTRIES TO DUTCH AGRICULTURE

Foreign countries are of varying importance to Dutch agriculture.

Dutch agriculture draws its supplies of raw material in the form of chemical fertilisers and cattle-feeds from abroad. The importance of these supplies may be gathered from the following tables:

Importation of Chemical Fertilisers in 1923.

	Weight in tons	Value in thousands of florins
Nitrate of soda	151,128	21,383
Nitrate of lime	2,809	361
Cyanamide	4,685	504
Sulphate of ammonia	21,354	3,686
Kainite	125,397	1,738
Potash	31,601	1,877
Potash salts	221,105	5,201
Superphosphate	80,869	2,589
Basic slag	288,417	9,439
Rock phosphate	223,266	4,290
Other fertilisers	27,234	1,473
Total . . .	1,177,851	52,541

Over-seas Importation of Cattle Feeds in 1923.

	Value in thousands of florins
Maize	66,5
Rye	11.0
Barley	23.1
Oats	5.7
Legumes	3.1
Cake and meal	63,8
Other cattle feeds	0,4
Total . . .	163,6

In 1923 therefore as much as 216 million florins' worth of these two important raw materials were imported for Dutch agriculture.

A large proportion of the agricultural machines were also imported, viz., in 1923, to the value of Fl. 2,743,000 and in 1922 of Fl. 3,944,000.

As a set-off against the importation of raw materials and agricultural machinery stands the exportation of the products of agriculture, stock-breeding and horticulture, which have already been dealt with in various parts of this report.

The following table gives the export value of the chief of these products:

Exportation of Agricultural Produce.

	Million florins	Million florins
Livestock	18,412	
Meat, fats and by-products	71,685	
Milk and milk-products	144,028	
Eggs	9,465	
Total animal products		243,590
Seeds and flour	15,818	
Legumes	15,946	
Oil- and other seed	12,821	
Potatoes	14,098	
Starch, dextrine, etc.	16,263	
Sugar beets and by-products	8,638	
Sugar	18,167	
Flax	6,613	
Hay and straw	2,195	
Straw cardboard and straw hats	18,851	
Total field products		129,420
Fresh vegetables	18,595	
Preserved vegetables	2,741	
Fresh fruit	5,085	
Preserved fruit	2,521	
Flower bulbs	26,383	
Cut flowers	534	
Nursery plants	4,525	
Total horticultural products		60,384
Timber		2,000
Total value		435,394

Hence in 1923, the value of the exports of the principal agricultural products was Fl. 435 millions.

It should also be borne in mind, as has already been pointed out in the case of horticulture, that 1923 was an unfavourable year. This is shown by the fact that during the first 8 months of 1924 the exportation of animal products alone was Fl. 242,404,000, or 165 % of that for the corresponding period of 1923.

Foreign countries are so important from the point of view of the importation of raw materials and the exportation of agricultural produce, that it naturally follows that where the world market controls prices, an enormous influence is exercised abroad on Dutch agricultural finance ; so much is this the case that the prosperity or failure of one of the chief sources of national prosperity such as agriculture, is to a great extent dependent on world conditions.

IMPORTANCE OF AGRICULTURE TO THE GENERAL WELFARE OF THE NATION.

From the above figures relating to importation and exportation it has already been shown that agriculture is of great importance to the public welfare in Holland.

This fact becomes still clearer when the large number of people engaged in agriculture and the annual value of agricultural produce are taken into consideration.

The figures in the employment returns for 1920 confirm the first point.

According to this return, in 1920 the number of independent persons engaged in agriculture was 222,000, and of those engaged in paid labour, 404,000, a total of 626,000.

As, according to this return, the total of employers and employees throughout the country was 2,503,000, it may be deduced that ¼ of the population find a direct means of subsistence in agriculture.

And as a part of the trade, industry and transport of the Country is closely connected with agriculture, it naturally follows that the indirect importance of agriculture is considerably greater.

The annual value of agricultural production may be estimated at :

	Millions of florins
field products	266.3
livestock products	331.1
milk products	298.4
garden products	127.2
forest products	8.0
Total	1031

The figures in the above estimate are based on the prices ruling in 1923, which were above the normal.

Owing to the very dense population of the country, Dutch soil can supply the needs of only half the number of inhabitants By a careful selection of crops and intelligent and continuous work, however, the value of the yield by the land available makes it possible to buy, from cereal-producing countries, a quantity of food-stuffs which it would be quite impossible for the soil alone to provide.

Thus, indirectly, agriculture has been made to contribute in the highest degree possible to the general welfare of the Country.

DR. J. J. L. VAN RIJN,

Report from the Dutch Government, transmitted to the International Institute of Agriculture by DR J J L VAN RIJN, *Delegate of the Netherlands and Dutch Indies.*

INTERNATIONAL ASSOCIATIONS

PROCEEDINGS OF THE INTERNATIONAL SOCIETY OF SOIL SCIENCE

Papers.

BROWN EARTH IN FINLAND.

According to RAMANN, the principal soil formation of Central Europe is composed of brown earths, which cover part of England, almost the whole of France, Germany, Austria, part of Denmark, South Sweden, Northern and Central Italy. According to RAMANN brown earths form in temperate climates and are related to the growth of deciduous trees (1). Brown earths are characterised by a dull, dark-brown colour, caused by the presence of iron oxide and humus matter. RAMANN assumes that the influence of the bed-rock is of special importance as regards brown earths.

According to RAMANN, brown earths do not contain alkalis, the soluble salts, including carbonates and sulphates, having been washed out. On the other hand, iron and aluminium oxides and phosphoric acid are not washed out, or only to a slight extent.

Although it may be admitted that RAMANN's theory as to the extension of brown earths is exaggerated, yet it is certain that brown earths play an important part in Central Europe from the point of view of soil science. And yet there is no exact description in the literature on the subject of this important soil type, especially as regards the central parts of the brown earth zone.

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(1) E. RAMANN. Bodenkunde, pp. 533 and 585.

The only exact explanation of the existence of brown earth is given by **KARL LUNDBLAD** (1), who describes the brown earth of Helgö, Småland, Sweden. In this region are mostly beech forests with typical brown earth formation, as well as needle-leaf forests, rich in moss, with normal podsol. The soil section is as follows :

0-3 cm.	Forest litter, beech leaves;
3-15 "	Very loose soil of granular structure, containing many earthworms ; the soil changes to a
15-55 "	Brown earth, of granular structure;
55- "	C- layer, moraine.

TABLE I. — *Moraine section, Helgö, Sweden* (2).

Brown earth.

Soil horizon	Weight percentage in air-dried soils			Weight percentage in mineral substances		
	A	B	C	A	B	C
Depth in cm. . .	3–13	15–32	100–115	3–13	15–32	100–115
SiO_2 . . .	65.42	79 99	72.90	76.18	74 69	75.18
TiO_2 . . .	0.53	0.59	0.55	0.61	0.63	0.57
Al_2O_3 . .	10 07	11 97	12.25	12.60	12.77	12.65
Fe_2O_3 . .	2 51	3.31	3.18	2.88	3.53	3.28
CaO . . .	1.08	1.41	1 84	1.82	1.51	1.90
MgO . . .	0.09	0.12	0 15	0.10	0.13	0.16
K_2O . . .	2.77	3 10	3.16	3.18	3.41	3.20
Na_2O . .	3.16	3.12	2.88	3.63	3 33	2.98
H_2O . . .	2.49	1.95	1.17	—	—	—
Humus. .	9 96	3.96	1.98	—	—	—
	99.21	99.62	99.18	100.00	100.00	100.00

The results of this analysis show that aluminium oxide and potash are similar in amount and silicic acid and sodium are increased in the A level, whereas iron oxide is washed out of the upper layer. The most important fact is that the humus is of a crumbly texture and is therefore very loose.

According to Dr. **OLAF TAMM**, who in the summer of 1923 demonstrated before some soil scientists the occurrence of brown earth, this brown earth changes very quickly if beech forest is replaced by needle-leaf forest. It must therefore be assumed that the formation of brown earth originates from the large quantities of fallen beech leaves. Under the influence of the needle-leaf forest the brown earth quickly changes to podsol.

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(1) **KARL LUNDBLAD**. Ett bidrag till kännedom om brunjords- eller mulljordstypens egenskaper och degeneration i Södra Sverge. *Medelanden från Statens Skogsförsöksanstalt*, Part 21, No. 1, 1924.

(2) **KARL LUNDBERG**. Op. cit.

As is known, large deciduous trees are very seldom found in Finland. The only " tree " which yields an abundant fall of leaves is the hazel (*Corylus avellana*). It might be supposed that this is perhaps the cause of the soil formation of brown earth. Hazel-bushes however are seldom found in Finland in forest plantations. Nevertheless there is one such instance, the Parish of Laitila in South-West Finland, where hazels are grown over an area of some hectares. The soil type is moraine, which has originated from Rapakiwi granite. A correspondingly typical brown earth formation has taken place in this soil type.

Section :

0-7 cm. a dark-coloured loose layer of granular texture and rich in humus (A-layer)
7-17 " dirty-brown humus (B_1-layer) ;
17-40 " grey-brown, containing humus (B_2-layer) ;
40 " moraine (C-layer).

There is no light-coloured earth.

TABLE II. — *Moraine section, Laitila, S. W. Finland.*

Soil horizon	Weight percentage in air-dried soils				Weight percentage in mineral substances			
	A	B_1	B_2	C	A	B_1	B_2	C
Depth in cm.	0–7	7–13	20–30	50–60	0–7	7–13	20–30	50–60
SiO_2	57.25	66.55	70.70	70.95	72.52	74.54	74.62	75.53
Al_2O_3 . . .	9.76	15.50	11.82	11.93	12.36	11.83	12.48	12.36
Fe_2O_3. . . .	3.83	3.91	3.75	4.95	4.86	4.38	3.96	5.13
CaO	2.18	1.70	2.10	1.80	2.76	1.90	2.22	1.87
MgO	0.86	1.27	1.13	1.08	1.08	1.42	1.19	1.12
K_2O	2.68	2.46	2.15	3.02	3.39	2.76	2.97	3.13
Na_2O	1.96	2.65	2.80	2.50	2.49	2.97	2.96	2.63
P_2O_5	0.37	0.18	0.28	0.22	0.47	0.20	0.30	0.23
SO_3.	0.05	—	—	—	0.06	—	—	—
H_2O	10.35	5.02	2.35	2.75	—	—	—	—
Humus . . .	10.51	5.49	2.60	0.47	—	—	—	—
	99.80	99.79	99.68	99.71	100.00	100.00	100.00	100.00

From this analysis it is evident that the soil formation differs from podsoil : the sesquioxides are not increased in the B-layer, Al_2O_3 is about the same in weight and Fe_2O_3 is washed out. Potash, phosphoric acid and especially lime are increased in the A-layer which contains humus. The high humus content in the B-layer causes the brown-grey colour.

As is known, the solubility of humus is an important factor in moist regions. The soluble humus matter protects the decomposed substances, which are in a colloidal state, and favours their displacement. The soluble humus matter predominates, especially in those moist regions where the soil type is poor in double bases, also in those where the granite bedrock is extensive (podsol district). On the other hand the humus matter, that occurring in chernos for instance, is very slightly soluble in water, according to P. KASSOWITZ (1) about 0.02 to 0.05 %.

The solubility of humus matter in water. — 10 gm. of earth were shaken up with 100 cc. of water and the soluble humus matter contained therein was estimated by means of potassium permanganate solution :

TABLE III.

				% of humus content	% of humus soluble in water, out of total humus
Brown earth,	Helgö.	Sweden,	A layer.	9.60	0.85
»	Helgö	»	B »	3.90	1.05
»	Lautila,	Finland,	A »	10.51	0.79
»	Laitila,	»	B »	5.49	0.78
Iron podsol,	Heinjärvi,	»	B »	7.28	1.55
»	Karjalohja,	»	A »	9.02	2.05
»	Karjalohja,	»	B »	2.18	0.94
Humus podsol.	Heinjarvi,	»	B »	3.17	7.03
»	Tikkurilla,	»	A »	41.87	1.47
»	Tikkurilla,	»	B »	2.41	6.83

From this table it is evident that humus matter, especially in the B-layer is least soluble in water in brown earths, and most soluble in water in humus podsols. The iron podsols come near the brown earths in this respect.

In the above table the soluble humus is expressed in % of total humus. But it is important in soil science to know the soil solution concentration as regards humus. In the following table the amounts of soluble humus per litre are shown:

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(1) P. KASSOWITZ. Die Schwarzerde. *Int. Mitteilungen für Bodenkunde*, 1912, p. 323.

TABLE IV.

				Humus dissolved per litre gm.
Brown earth,	Helgö,	Sweden,	A layer	0.0824
»	Helgö,	»	B »	0.0412
»	Laitila,	Finland,	A »	0.0883
»	Laitila,	»	B »	0.0432
Iron podsol,	Heinjärvi,	»	B »	0.1130
»	Karjalohja,	»	A »	0.1853
»	Karjalohja,	»	B »	0.0205
Humus podsol,	Tikkurilla,	»	A »	0.6178
»	Tikkuriila,	»	B »	0.1647
»	Heinjärvi,	»	B »	0.2059

The humus matter occurring in brown earths especially, though also in iron podsols, is very slightly soluble in water and forms weak solutions. On the contrary that in humus podsol dissolves more easily.

These examples show the importance of humus matter in soil formation. In similar conditions, that is when climate and bedrock are similar, humus podsol with well-formed light-coloured earth layers, is found under the crude humus, because the humus matter dissolves easily in water, on the contrary iron podsols and brown earths form if the humus matter is less soluble in water.

The formation of brown earths is in these cases dependent on the vegetation, for the influence of climate and bedrock would cause a podsol formation. Through the abundant leaf-fall the lime content especially, is increased in the upper layer (cf. table II), and flocculates the humus matter, changing it into a very slightly soluble type. In this case the humus matter does not favour washing out and there is no layer of light coloured earth. Owing to the abundant formation of humus the upper soil levels are rich in humus matter, yet this exerts no protecting influence. Through the presence of humus the colour of the upper soil layers is a dirty-brown.

No observations have been taken as to the yearly leaf and needle-fall in northern countries. The variations in Bavaria, however, according to EBERMAYER, are not very great: in beech plantation

4100 kg, in spruce plantations 3500 kg and in common pine plantations 3700 kg per hectare In young plantations, with the exception of pines, the total is generally somewhat higher

TABLE V — *Amount of air-dried leaf- and needle-fall per hectare per annum* (1)

No of observation posts	Age (years)	Proportion of mixed timber	Average yield in kg per ha
In beech plantations 11	27–56	Beech only and with oak birch and aspen	4182
» 7	66–85	Beech only and with oak, birch and pine	4094
» » 7	91–130	Beech only and with oak spruce and pine	4044
In spruce plantations 12	34 59	Spruce only and with fir maple and larch	3364
» 9	60–80	Spruce only and with fir beech and maple	3376
» 10	94 125	Spruce only and with fir and maple	3275
In pine plantations 10	25 48	Pine only and with spruce and larch	3597
» » 6	61–74	Pine with beech spruce and oak	3491
» » 5	86–107	Pine with beech spruce and oak	4229

The variations in the quantity of potash and lime are considerable

TABLE VI *Total potash in forest litter*

	1 parts of dry matter contain (in gms)				
	K₂O	CaO	MgO	P₂O₅	Total potash
Beech leaf litter (1)	2 97	24 62	3 64	3 14	55 76
Spruce needle litter (1)	1 61	20 27	2 32	2 14	5 27
Pine needle litter (1)	1 52	3 95	1 51	1 10	14 65
Various forest mosses	7 61	5 47	2 51	4 78	30 98
Yellowed hazel leaves (2)	12 37	32 17	4 95	5 90	—
Yellowed beech leaves (2)	9 42	18 49	5 06	1 78	—
Decayed oak leaves (2)	4 99	33 70	4 16	3 59	—
Decayed birch leaves (2)	7 25	33 27	3 28	2 09	—

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(1) EBERMAYER Op c, p 108

(2) E RAMANN Wanderung der Mineralstoffe beim herbstlichen Absterben der Blätter. *Vers Stat* 76, pp 157 160, 1912

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(1) E EBERMAYER Lehre der Waldstreu, pp 44 49, Berlin, 1876

If, according to Ebermayer, the potash content per year per hectare of the annual yield of completely dry litter be determined, the following mineral nutrient substance content of the upper soil layer, in kg. per ha, is obtained :

	Dry litter per year	Total potash	K_2O	CaO	MgO	P_2O_5
Beech leaf litter	3331	185.54	9.89	82.01	12.12	10.46
Spruce-needle litter.	3007	135.92	4.84	60.95	6.98	6.43
Pine-needle litter.	3186	46.52	4.84	18.96	4.81	3.70

The lime content of the beech-leaf and spruce-needle litter is considerable in comparison with that of the pine-needle litter. If, in addition to this, it be borne in mind that the very resinous spruce and pine-needles take much longer to rot than the leaf-litter, it will become clear that leaf-litter favours the formation of the more coagulated humus.

This kind of humus is formed principally in dry places ; in areas where the water level is high, the lime is washed out, whereby the solubility of the humus matter is increased.

The brown earth formation occurs in Finland only in certain places and forms flats of small extent. It should also be observed that these soil formations, which lie outside the true brown-earth zone, differ to some extent from the brown earths of the central parts of the zone. For instance, according to Stremme (1), the German brown earths at the boundary of the subsoil are characterised by concretions of calcium carbonate ; this phenomenon does not take place at all in the brown earth formation of Finland. If the general character of these soils be taken into consideration however the last-named must be classed before the sesquioxide soils (2).

The brown earths in Finland, differ from the podsols by the absence of light-coloured earth and the fact that their humus matter is less soluble in water. A low sesquioxide content and slight difference as regards bedrock is common to both these soils.

B. Aarnio.

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(1) H Stremme. Bodentypen in Deutschland, *Mémoires sur la nomenclature et la classification des sols*, p 2, Helsingfors, 1924

(2) B Aarnio and H Stremme. Zur Frage der Bodenbildung und Bodenklassifikation *Mémoires sur la nomenclature* etc, p. 73.

Abstracts and Literature.

General.

The Bases of Petrography.

ERDMANNSDOERFFER, O., *Grundlagen der Petrographie*, pp 321, illust. 119. Publ by Ferd Enke, Stuttgart, 1924

The author shows the connection between the geological, physico-chemical and mechanical bases of the science of petrography. In this work the geologist is shown the direct application of general knowledge to the problems which specially interest him, and the mineralogist, whose attention is directed more towards the physical and chemical branches of science, the application of the results of his researches on the processes in the great laboratory of Nature

After a general introduction, the separate chapters deal with: the lithosphere, the glacial rocks, magnetic conditions, the period of formation of the magma, the structure, texture and sectional formation of the glacial rocks, the causes of metamorphism and its products in their geological relations The separate chapters are accompanied by detailed references to the literature on the subject.

This important work of ERDMANNSDOERFFER is in every respect one of the best from a scientific point of view. SCHUCHT.

A Manual of Mineralogy.

GOSSNER, Dr B., with a portrait of G AGRICOLA, *Lehrbuch der Mineralogie.* 4 Plates and 465 text illustrations Publ by Fr Brandstaetter, Leipzig

The present work is in a certain sense the successor of that by F. v. KOBELL, from which a number of the figures in the text are taken. It should serve as an instructive manual, condensed, but at the same time as complete as possible, in order to give a comprehensive view of the many branches of mineralogy and should be especially useful to students of chemistry, geology, natural science and mining

This excellent work, of a high scientific type, is divided into two principal parts: I. General mineralogy; II. The system, formation and occurrence of minerals (special mineralogy). These two parts are subdivided as follows:

Part I.: Mineral physics (the form of crystals — formation and dissappearance of crystals — cohesion — crystals and their radiant-energy — structure — the crystallographic phenomena of certain minerals). The chemistry of minerals (the general composition of minerals — the chemical bases of mineral formation). Minerals from a geological point of view (general causes of the existence of mineral stratification — system of mineral stratification).

Part II : Silicates — oxides (including hydroxides) and their compounds — mineral sulphides — mineral salt compounds of the common acids. Appendix: Rare or unclassified substances. L. G.

Soil Science for Farmers and Foresters.

MITSCHERLICH, Dr EILH ALFR, *Bodenkunde für Land- und Forstwirte* 4th Edition (revised) with 37 text illust Publ P Parey Berlin, 1924

The new edition treats of recent research and knowledge in the plant physiology branch of soil science.

MITSCHERLICH's "Soil Science" is so well known that any further recommendation is unnecessary. SCH.

A Manual on Geology.

KOBER, Prof. Dr LEOP, *Lehrbuch der Geologie* Illust 325, maps 2, and 30 plates Publ by Hoelder, Pichler, Tempsky & Co, Vienna, 1924

Contents: Biology as a Science — Review of the history of the formation of the earth — General structure of terrestrial bodies — Rocks of the earth's crust — Stratification of the rocks — Volcanic phenomena — Climatic zones of the earth and their geological importance — The action of water and air — The activity of organisms — Movement of the earth's crust — The geosynclinal zones and glacial continental masses — The most important groups of fossil plants and animals — Structure of the earth — General laws and theories — Treasures of the soil — Geological-palaeontological-atlas-index.

A book to be recommended. SCH

A Petrographic "Vademecum".

WEINSCHENK *Ein Hilfsbuch fur Geologen, Geographen und Techniker* (An Aid to Geologists, Geographers and Technologists) Revised by JOSEF STINY IV Edition (revised) 256 pp, 1 Plate, 104 text illustrations Publ. by Herder & Co, Ltd, Freiburg im Br, 1924

WEINSCHENK's well-known book, which constitutes a "Petrography without a Microscope" has been further improved by its reviser in accordance with the progress of science, and can be strongly recommended to all soil scientists on their expeditions into the mountains. SCHUCHT

A General Chart of the occurrence of Potassic Salts and Petroleum in Germany.

Übersichtskarte der Deutschen Kalisalz- und Erdölvorkommen Scale 1 . 450 000. Published by the "Preuss Geolog Landesanstalt" (Prussian National Geological Institute) compiled by ERNST FULDA, Member of the Mining Council ("Bergrat"), Gea-Booksellers, Ltd, Berlin W 35

The new potash chart includes those parts of the Provinces of Hanover, Saxony, Hesse-Nassau and the territories lying between them from which potassic salts are extracted. It includes not only geological data, but also data connected with mining, such as potash mines, potash works, salt mines, the mining-district boundaries, etc. and is completed by explanatory notes. The chart is excellent, both on account of the clear colouring and comprehensive contents, and can therefore be highly recommended.

SCH.

Physical Properties of Soils.

Influence of Water on Soil Granulation.

BOUYOUCOS G. J. (Michigan Agricultural Experiment Station). *Soil Science*, Vol. XVIII, No. 2, pp. 103-110, 1 table. Baltimore, Md., 1924.

One of the most interesting physical phenomena in the soil is its persistent tendancy to assume a granular form when exposed to certain processes connected with the weather, such as the alternation of moisture and dryness. The natural soils of the fine texture type have almost always this granular type, which is so necessary for plant growth. Also when the soil is liable to caking, becoming dense and hard, it begins to crumble if subjected to alternate moisture and dryness. It is generally agreed that the granulation is due to the force of contraction of the pellicles of water in the soil. When the soil moisture begins to diminish by evaporation, the power of contraction of the pellicles of water increases, the pellicles becoming finer and finer, causing the soil particles to become attracted one to another, the soil thus becoming flocculated. This theory however is not correct, for otherwise the soil would tend to contract more and more into a dense mass, and there would no longer be any granular structure. Soil granulation on the contrary means not only the flocculation of the particles into larger ones, but also the crumbling of dense masses into others of loose structure.

Water participates in the process by detaching the particles from one another, being enabled to do this through the swelling of the colloids and by decreasing the cohesive power of the particles. Thus the clods acquire a granular structure. The force of contraction on the other hand is due not to the water pellicles, but to the cohesive power of the soil itself.

A. F.

The Effect of Movement of Soil Salts on the Standardization Values of Electrodes used in Soil Moisture Determinations.

DEIGHTON T., *Journal of Agricultural Science* 13, 440, 1923.

Aims at determining to what extent the movement of soil salts affects electrode standardization values in a method for determination of soil moisture previously described. Fairly light soil packed in a large box, with constant water table, is presumed to have moisture content dependant on temperature and relative humidity of air at surface only. Units of 3 electrodes were sunk at 3 ", 4 " and 6 " depths ; 3 resistance thermometers were used at the same levels. Fluctuations of resistance were measured (i) while the system was coming to an equilibrium, (ii) after application of varying quantities of " Artificial rain " applied at surface. Conclusions were reached to the effect that at 3 ", or at a lower depth relative humidity exerts no effect, nor did 1 mm. of rain affect these levels.

Several of the results were erratic, but the evidence available seemed to show that on normal soils small rainfalls would not materially affect standardization values T. E.

The Soil Point Method for directly Estimating the Water Supplying Power of a Soil in the Field.

HARDY, F. *Journal of Agricultural Science*, 13, 365, 1923.

Develops under field conditions MASON's laboratory investigation on the same subject *i. e.*, the use of the conical surface of sharpened high grade graphite writing pencils for the absorption of moisture in the soil. Fifty pencils in lots of ten constitute one trial. The depth of absorbing surface below ground is 5"; time 3 hours. The probable errors quoted are insignificantly small. The following figures refer to the water supplying capacity of the soil at drying point in terms of hundredths of a gram of water absorbed by one soil-point in the specified time : MASON 1 41 = 0.031, HARDY 1.71 = 0.066. T. E.

The Maximum Water Retaining Capacity of Colloidal Soils, etc.

HARDY, F. *Journ. of Agricultural Science*, 13, 340, 1923.

The soils dealt with are representative of the diverse geological types of the British West Indies. Investigations were made chiefly with respect to their behaviour in the light of (i) The Briggs-Shantz formula for Maximum Water Retaining Capacity, $M = 4.3\ H + 21$; (ii) a formula $M = P + 23.5$ ($P = \%$ moisture when in a plastic state) derived from WILSDON's theoretical considerations. Data are given showing that the BRIGGS-SHANTZ formula holds for soils without highly marked colloidal properties but the experimental values are in excess of those calculated for soils of high siliceous colloid content. Such soils swell during imbibition and the soil mass is loosened with consequent increase of pore space.

Red laterite soils show the opposite effect, as their colloidal material is mainly alumina and ferric oxide hydrogel ; their volume expansion is low. Humus soils have a high volume expansion and resemble siliceous colloidal soils in the nature of their deviation from the BRIGGS-SHANTZ formula.

WILSDON's "Vesicular coefficient" $\frac{P}{H}$; theoretically estimated as 4.3, varies from 4.9 to 3.3 for the first class of soils and from 3.5-2.4 only for the second. This is believed to account for low experimental values for the BRIGGS-SHANTZ formula in the laterite soils. The second formula is approximately correct for laterite soils but is not suitable for the other types. The reliability of the drying coefficient and critical moisture content formulae is examined in the light of the data and conclusions given. T. E.

Soil Moisture Investigations in Canada.

HOPKINS, E. S. (Central Experimental Farm, Ottawa) *Scientific Agriculture*, Vol. V, No. 3, pp. 79-83. Ottawa, 1924.

An outstanding fact of Canadian agriculture is the wide variations which occur from year to year in the yield of wheat grown in the Prairies Provinces. In Alberta the yield has ranged from 6.0 bushels per acre in 1918 to 32 7 in 1915 ; in Saskatchewan from 8.5 to 28.5, whereas in Ontario the extremes have only been from 12.5 to 23.2 bushels.

The average yields per acre for the past 23 years for wheat exporting countries (Russia 15 years) are as follows: Canada 17.8 bushels, United States 14.1, India 11.3. Australia 10 6 Russia, 9.4.

Poor yields are due partly to rust, but the most important cause is drought.

The Dominion Experiment Farms have shown that timothy, red clover and alsike do not succeed on the prairie ; western rye and brome grass are more drought resistant. The summer fallow may be replaced by maize, which in addition to giving a crop leaves the land in good condition for wheat and the stubble prevents the dry soil from blowing away.

At the Swift Current Station it has been shown that for the years 1921-1922 it has taken 1221 lb. of water (including transpiration and evaporation) to produce 1 lb. of wheat grain, on which basis 6.5 inches of water would be required to produce a 20 bushel crop. Rainfall appears to have the most beneficial effect about the time of heading. It has been proved that the soil mulch is not sufficient to conserve soil moisture. Weeds are the great enemy, not only as regards soil nutriment but also of moisture.

A study of statistics indicates that the hay crop varies the most, oats the next and maize and silage the least. Experiments are being carried out to ascertain which rotation is most economical in its use of soil moisture, as by the inclusion of different types of crops a certain amount of safety may be obtained in years when the rainfall is deficient. W. S. G.

The Moisture Equivalent of Heavy Soils.

JOSEPH, A. F., and MARTIN, F J *Journ of Agricult Science*, 13, 49, 1923.

Moisture equivalent is defined as the percentage of moisture retained by the soil after draining centrifugally for 40 minutes by a force of 1000 times that of gravity. Results showed that increased thicknesses of soils in the perforated boxes decreased the moisture equivalent by increasing the density of the lower layers and reducing pore space. With certain heavy soils, closely compressed, impermeability causes accumulation of water in surface layers and consequent increase in moisture equivalent. Clay content is not the only factor ; the water logged soils were those of higher P_H value. Salt content caused variations of the moisture equivalent which was increased by deflocculating agents such as sodium carbonate, and decreased by flocculating salts.

Sodium carbonate gave a distinctive curve for the moisture equivalent — Na_2CO_3 concentration relationship. Moisture equivalent reaches maximum value at a concentration of 2% and then falls off. Variations in the content of colloidal clay produced variations in moisture equivalent, but of small degree. No such effect was noticed with other colloids such as kaolin.

T. E.

The Form of Mechanical Composition Curves of Soils, Clays and other Granular Substances.

ROBINSON, G. W. (University College of North Wales). *Journal of Agricultural Science*, Vol. XIV, Part. 4, pp. 627-633, figs. 2, bibliography. London, 1924.

The article describes the results obtained of the mechanical analysis of a large number of soils, clays and other granular materials, carried out by the author's method. The results are set out in the form of curves showing the relationship between summation percentages and logarithm of settling velocity. The curves are smooth, which indicates that a comparatively small number of determinations are sufficient to characterise the mechanical composition of a soil or clay

The curves for ordinary soils and clays are found to show one general type and two subtypes, illustrated in Fig. 87.

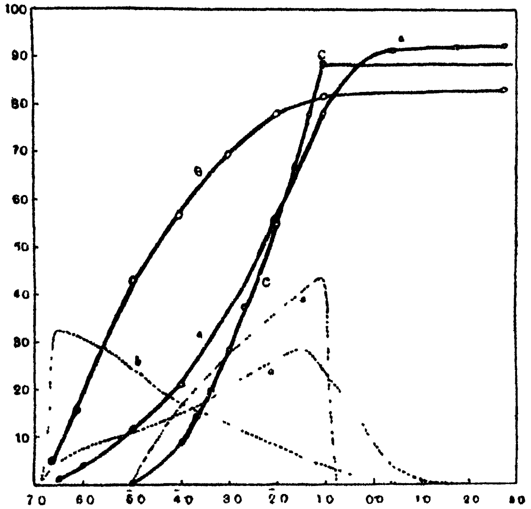

FIG. 87 —Principal types of curves illustrating the mechanical composition of soils.

The most common type of curve, to which the great majority of soils belong, is the sigmoid, as exemplified by curve A. The steepest portion represents the fraction present in greatest frequency, this being termed by the author the *modal fraction*. Two variants of the main type of curve were encountered, one in the case of very heavy clays, as shown by curves B and *b*, in which the lower portion of the sigmoid appears to be supressed, so that the modal fraction falls to the lower limit.

In the case of certain materials which have been reduced to powder by grinding, as for example slate powder, represented by curves C and *c*, the modal fraction appears to be at the upper limit.

The lower limit of particle size appears to be represented by log $v = \bar{7}.0000$ in the case of normal soils and clays.

In the case of kaolin and certain finely divided but non-plastic materials, the lower limit appears to be in the region of $\bar{5}.0000$ The author suggests that the properties of soils would be better shown by taking the limit for clay at this point instead of at log $v = \bar{4}.0000$, if this were adopted then the difference would be more clearly shown between plastic substances and materials which, although in a fine state of division, have not the characteristic properties of clay.

The use of the logarithm of settling velocity as a measure of particle size is discussed and it is suggested that the use of negative logarithms might be avoided by using log $(v + 10^7)$, for which the symbol L v is proposed.
W. S. G.

Chemical Properties of Soils.

The Determination of Ammonia in Soil.

BENGTSSON N (Central Agricultural Experiment Station, Stockholm). *Soil Science*, Vol. XVIII, No 4, pp. 225-268, bibliography. Baltimore, Md , 1924.

The author has revised the methods hitherto employed for the determination of ammonia in soil and has found that with none of them can the whole of the added ammonia be recovered.

The test showed that it is impossible to carry off all the ammonia in a soil extract. It is therefore necessary to adopt the method of successive extracts proposed by the author. For this purpose 25 grams of soil are extracted successively with 7 portions of 100 cc. of a solution of 4 % chloride of potassium For peaty soils, on the other hand, portions of 50 cc. are be used. The method is not suitable for clay subsoils taken at a depth of 25-35 cm.
A. F.

Secular and Seasonal Changes in the Soil Solution.

BURD J. S. and MARTIN J. C (University of California Experiment Station). *Soil Science*, Vol XVIII, No 2, pp. 151-167, bibl Baltimore Md, 1924.

Crops continued for a long period constantly diminish the concentration of soil solutions, which are obtained by the displacement of water. By leaving the soil fallow, on the other hand, the concentration of such solutions is increased, except in soils in a state of high fertility.

In soils cultivated continually for some years the seasonal decreases of concentration are only temporary, while such concentrations tend to increase in the season following that in which there was a decrease. There are also characteristic fluctuations of certain constituents, and the phosphates essentially depend on the reaction of the solutions.

It is evident that the qualitative composition of the soil undergoes continual changes. It follows that the solutions for water cultures, made to reproduce the conditions of the soil at the beginning of the season, no longer represent the conditions found in the succeeding stages of plant growth. A. F.

The Influence of Hydrogen-ion Concentration and Different Salts on the Electrical Charge of Clay Colloids.

DAYHUFF, W C. & HOAGLAND, D R (College of Agriculture, University of California). *Soil Science*, Vol XVIII, No 5, pp 140-408, bibl. Baltimore, Md, 1924

It is known that the physical conditions of a soil depend to a great extent on the colloidal state of the clay fraction, and it would be interesting to know how the reaction and electrolyte content of the soil solution might modify the state of the clay dispersion In such systems, one of the must influential factors is the electric charge of the colloidal particles

Some years ago ARRHENIUS had advanced the theory that the clay could act as an ampholyte and therefore behave similarly to protein, in accordance with LOEB's idea. The authors' investigations on the contrary have shown that, at least as regards the clay type examined, the colloids possess no definite isoelectric point (unlike protein) in the series of hydrogen-ion concentrations examined (from P 2 1 to 12 7). The colloids continue to remain charged negatively.

On the stability of the colloidal clay suspension, the nature and concentration of the cations, on the contrary, have the greatest influence. It may be that in the soil conditions are somewhat different; there may be certain organic colloids present, which may behave differently.

The question is important also from the practical point of view. As is known, an alkaline reaction of the soil is not unfavourable to plant growth. This may be due not only to the direct influence on root growth, but also to the influence on the physical state of the soil itself, whereby an unfavourable state for root growth and for the activity of microorganisms is created The alkaline reaction in fact may cause deflocculation, decreasing the solubility of the di- and tri-valent cations, instead of influencing the hydroxylion concentration. A. F.

The Science of Soil Solutions: Methods for Obtaining and Testing Soil Solutions.

DOJARENKO, A. G, Prof *Journal fur landwirtschaftliche Wissenschaft* 9-10. State Technical Publishers, Moscow, 1924.

This essay describes the principles and methods for the testing of soil solutions, which are important in agriculture. The author, in collaboration with his colleague A A SCHNIWCK, proposes a method for obtaining a solution without diluting with water, for which purpose use is made of the " Petroleum Emulsion method ". The freshly-obtained soil samples of which the water content must be more than double the hygroscopic water capacity, are well mixed with a certain quantity of a completely neutral and chemically inactive oil (vaseline oil), so that the oil forms an emulsion with the soil solution; from this, by slight pressure and subquent centrifuging, the soil solution, free of oil, is obtained. The following means for testing the soil solution are adopted: osmotic pressure, measurement of conductivity, degree of solubility of the electrolyte, colloid content, refraction exponent, rotatory power, chemical-calorimetric determination, titration of the oxidising compounds with permanganate.

GOERNER.

A Comparison of Qualitative Tests for Soil Acidity.

HARPER, H J & JACOBSON, H. G M. (Iowa Agricultural Experiment Station) *Soil Science*, Vol XVIII, No. 2, pp. 75-85, bibl. Baltimore, Md, 1924.

The different methods of testing enable very acid soils to be distinguished from medium and slightly acid soils. The Soiltex method also distinguishes neutral and basic soils, and has the additional advantage of requiring but few appliances, but with peat and clay soils the solutions obtained are not sufficiently clear. TRUOG'S test requires more appliances and a longer time than the others, this method and COMBER'S potassium salicilate test give accurate results with moist soils The Iowa method gives good results with soils containing 20 % moisture, and RICHOPOOR'S only with dry soils. A. F.

On the Determination of the Influence of Soil " Buffer-Action ".

JENSEN TOVBORG S (Statens Forsogsvirksomhed i Plantenkultur) Om Bestemmelse af Jordens Stodpudevirkning *Tidskrift for Planteavl*, Vol 30, No 4, pp 565-585, figs 21, bibliography Copenhagen, 1924

The author has determined the P_H variations in a soil suspension (10 gm) in a constant volume of liquid (100 cc), by adding thereto increasing quantities of hydrochloric acid and calcium hydrate in decinormal solutions. In order to investigate the influence of carbonate of lime on soil reaction, the calcium hydrate added was transformed into carbonate of lime by the addition of carbon dioxide at atmospheric pressure. According to N BJERRUM and J. K GIALDBOEK, in a liquid saturated with carbonate of lime, the P_H value may be expressed by the following equation:

$$P_H = 5.02 + \frac{1}{2} \log C_{Ca++} + \frac{1}{2} \log . pCO_2$$

in which C_{Ca++} is the molecular concentration of the calcium ions and pCO_2 is the pressure of the carbon dioxide in the liquid

For a liquid saturated with carbonate of lime at the normal pressure of carbon anhydride $P_H = 8.38$. It follows that the extreme limit of P_H in a soil suspension, to which is added increasing quantities of carbonate of lime, is 8.4, provided the soil in question does not contain large quantities of alkaline, or other strong carbonates. When the transformation mentioned does not take place, the carbon dioxide of the atmosphere will cause a partial transformation of calcium hydrate to carbonate and the P_H will diminish in relation with the pressure of carbon dioxide in the atmosphere.

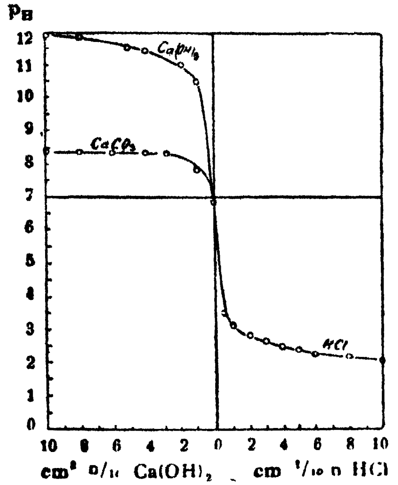

FIG 88. — Standard curve showing buffer action in quartz sand

The P_H determination was made in a soil deprived of "buffer action", formed of pure quartz sand (Fig. 88). The results were expressed in graphs in which the quantities of calcium hydrate and hydrochloric acid added in decinormal solutions are in the ordinates, and the ascertained P_H values in the abscissae. The results obtained with the soils examined were expressed in a similar manner. In the diagram then, if the soils in question have no "buffer action" influence, the lines will coincide, whereas on the other hand, the greater such influence, the greater will be the deviation.

The exact value of the soil "buffer action" influence on the acid in a determined P_H interval, is expressed by the difference in length between distances at which the type curve and that of the soil examined intersect the horizontal lines which represent the same P_H intervals (Figs. 89 and 90). Such

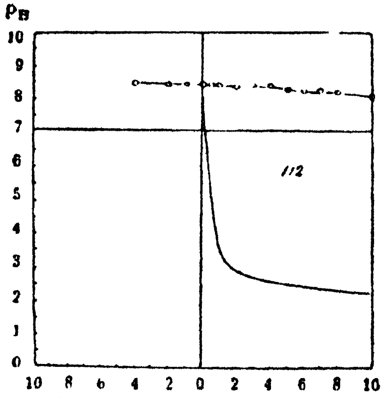

FIG 89 — Curve showing buffer action of garden soil.

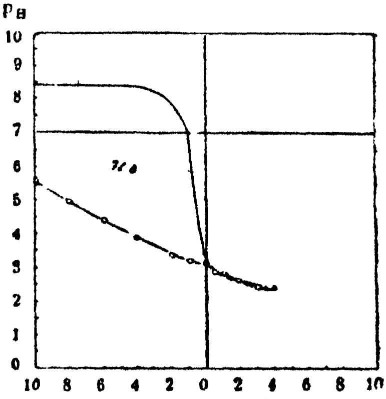

FIG 90 — Curve showing buffer action of soil from a dry pond.

difference in length shows how many cc. of decinormal hydrochloric acid can be held by 10 gm. of soil, when the P_H values diminish within the limits shown by the interval. A. F.

Alkali Soil Investigation. Chemical and Biological Effects of Treatments.

JOFFE, S. S. and MACLEAN, H. C. (New Jersey Agricultural Experiment Station). Alkali soil investigations : chemical effects of treatment *Soil Science*, Vol. XVIII, No. 2, pp. 133-149, bibliography.

Id. IV. Chemical and Biological Effects of Treatments. *Ibidem*, No. 3, pp. 237-254, 1 table, bibliography Baltimore, Md., 1924.

The results of the first series of tests show that treatment with 2000 lb. of sulphur per acre is not sufficient to completely transform the soil alkalis. The total of hydrogen ions from 2000 lbs of sulphur is not sufficient to substitute the zeolitic cations and neutralise the existing and potential soda. Alum, especially in combination with sulphur, may exert some influence.

It should be borne in mind that the soils examined contain soda and sodium in their zeolitic portion. Now when the colloids are coagulated, the carbonates begin to disappear ; some are changed into bicarbonates, others disappear, as is the case with carbonic anhydride, of which a part is utilised by the microflora. The first reactions take place with the carbonates in so far as they are solution reactions, and these are then followed by replacement reactions.

From the nature of the cations, it will be expected that the first to disappear must be the sodium, followed by calcium. By frequent determinations it is possible to ascertain the moment in which the whole of the sodium has been substituted ; only then is leaching resorted to. The oxidation of the sulphur that follows the leaching, supplies the hydrogen ions for replacement of the calcium which forms gypsum. When all the sulphur has been oxidised and all the hydrogen ions have been exhausted, the reverse reaction takes place, as shown in the following equation, which is reversible :

$$\mathrm{Ca\,Al_2\,Si_x\,O_y\,.\,nH_2O + H_2SO_4 \rightleftarrows H_2\,Al_2Si_x\,O_y\,.\,nH_2O + CaSO_4\,.\,H_2O}$$

The quantity of sulphur necessary is probably 4000-6000 lbs per acre.

The combined effects of the sulphur and alum resulting in improvements of alkali soils lead one to conclude that it is possible to use both these products for that purpose. The advantage would be that the alum would immediately coagulate the colloids, and the hydrogen ions of the sulphuric acid would then be utilised for replacement of the sodium. Further investigation is necessary however before defining the practical application of these two agents.

The use of organic substances, such as peat or large quantities of stable manure is effective in so far as they serve as a buffer ; they do not, however, contain cations capable of reacting on the zeolitic portion of the soil. In any case their effectiveness is only temporary, and is perhaps due to the introduction of some substance which serves in plant nutrition.

The authors have also investigated the biological effects of treatment, but the data obtained do not up to the present allow any conclusions to be drawn. In general, the authors' investigations would afford a theoretic basis for the views of GEDROIZ. The practical conclusions might lead to modifications in some particulars, but on the whole it is probable that from the results of these investigations one might proceed to their application. A. F.

Adsorption and Absorption of Bases by Soils.

JONES, C. P. (Massachusetts Agricultural Experiment Station). *Soil Science*, Vol. XVIII, No. 3, pp. 255-273, 1 fig., tables 8. Baltimore, Md., 1924.

The colloids of the soil may be divided into two great classes: inorganic and organic. Silicic acid, silicates, aluminium hydroxide and its silicic acid and ferric hydroxide compounds belong to the former. Among the organic colloids are the humus compounds and the various species of micro-organisms such as soil bacteria and fungi as well as the mucous matter secreted by such micro-organisms.

The colloids are capable of adsorption and absorption. The former is a surface phenomenon and is not considered to be of great importance, whereas absorption is important. The latter, which might also be called decomposition-adsorption, is a chemico-physical reaction and depends on the chemical nature of the colloids which enter into reaction.

The absorption of the bases by the soil is directly dependent on the degree of hydrolysis of the salt in solution. Hence the laws which govern hydrolysis, *i. e.*, chemical composition of the salt, concentration, and temperature, apply also to absorption.

The absorption of the bases of the compounds, which contain a strongly ionised base and an acid, is small. With the decrease of the ionisation of the base and of the acid there is an increase in the degree of hydrolysis and consequently an increase in the absorption of the base. This, in but slightly soluble substances, follows WENZEL's law: the speed of reaction of the solids with the liquids is proportionate to the air in contact with them.

The absorption of the bases by the soil is due to the chemical reactions between the constituents of the soil and the dissolved salts. Adsorption, or surface attraction, is merely accessory. A. F.

Drying of the Soil and Maintenance of Fertility.

LEEBEDJANTZEV, A. N. (Shatiloff Agricultural Experiment Station). Drying of the Soil as one of the Natural Factors in Maintaining Soil Fertility. *Soil Science*, Vol. XVIII, No. 6, pp. 419-447, tables 24. Baltimore, Md., 1924.

The drying of soil to an air-dried condition in the open air at ordinary temperature, produces a large increase in the yielding capacity in the case of pot experiments.

Especially responsive to drying appear to be uncultivated soils and those under grass for a number of years; soils under continuous mechanical cultivation respond less readily. Soils fertilised with farmyard manure or phosphates are more responsive than unfertilised soils. Meadow grasses show the best results with soil drying.

A positive influence of drying is evident only with cultivated soils reaching a 6 per cent content moisture, and with uncultivated soils reaching 14 per cent. With a less amount of drying, fertility is not increased and may even be lowered. Repeated drying of the same sample of soil, with intermediate moistenings, is accompanied by a further increase in the yielding capacity and the maximum fertility is attained with triple drying.

The maximum effect of drying for deep black soil seems to be in the layers 20 to 40 and 40 to 60 cm. For surface soils (0 to 20 cm.) as well as for the layers lower than 60 cm., it is markedly less.

During the process of drying, important chemical changes take place in the soil which tend to increase the solubility of organic substances and to enrich the soil in nitrogen and phosphorus, and to bring about a large increase of ammoniacal nitrogen, a considerable increase of amide nitrogen and a diminution in micro-organisms. These changes are very similar to those taking place in the soil under the influence of low temperatures and antiseptics, so that the drying of a soil may be considered as partial sterilisation. The factors most important for ensuring these effects are dehydration and temperature, while oxygen and light cause a decrease in fertility

An indirect proof of the favourable action of the drying on fertility is given by the fact that the upper 5 cm. layer is the most fertile and also increases its fertility most rapidly. A. F.

The Influence of Various Salts on Acid Soils.

MIYAKE, K., TAMACHI, I. and KONNO, J. (Institute of Agricultural Chemistry, University of Hokkaido, Sapporo, Japan) The Influence of Phosphate, Biphosphate, Carbonate, Silicate and Sulphate of Calcium, Sodium and Potassium on Plant Growth in Acid Mineral Soils *Soil Science*, Vol. XVIII, No. 4, pp. 279-310, tables 7, bibl, Baltimore, Md 1924.

The study of acid mineral soils and the improvements to be made in them is very important for Japan, where such soils are very extensive. The low fertility of these soils is especially due to the presence of large quantities of aluminium, which seem to have a toxic effect on plants.

The authors' experiments have shown that soil acidity may be reduced by the addition of carbonate, phosphate, biphosphate and silicate of lime, soda and potassium, whereas sulphate has no effect. By the addition of such salts, the hydrogen-ion concentration is also reduced, but not to the same extent as the acidity.

The quantity of aluminium which passes into solution with potassium chloride, after the addition of the said salts, corresponds with the acidity, which latter therefore seems due to the quantity of dissolved aluminium.

The salts, arranged in the order of their power to render aluminium insoluble, are the following: carbonates, phosphates, biphosphates and silicates. The sulphates, on the contrary, increase the quantity of soluble aluminium.

In the tests made with barley, the order of beneficial influence is as follows: phosphates, biphosphates, carbonates and silicates, while the unfavourable influence of the sulphates is confirmed. The order is therefore the same as that in which aluminium is rendered insoluble, except that the phosphates and carbonates have exchanged positions. It is deduced therefore that the presence of large quantities of aluminium in acid soils is a very important factor in connection with the low fertility. The greater influence of the phosphates seems to be due to the deficiency of phosphoric anhydride in such soils.

Although hydrogen-ion concentration is also reduced by the addition of the said salts, it was impossible to prove that there was any connection between it and plant growth.

It is therefore concluded that " the inferior quality of an acid soil as regards plant growth is due, at least to a certain extent, to the presence of soluble aluminium, which is decidedly toxic to plants, and to the deficiency of phosphoric anhydride. " These chemical products which can give the necessary quantity of phosphoric anhydride and cause the elimination of soluble aluminium are therefore most suitable for such soils. A F.

Determination of the Hydrogen-ion Concentration of Soils by the Colorimetric Method.

NIKLAS, H and HOCK, A *Zeitschrift fur angewandte Chemie*, v. 38, p. 150. Leipzig, 1919.

The authors describe the principles of the colorimetrical determination of the hydrogen-ion concentration in soils by CLARK and LUBS' test, also by that of MICHAELIS, and show the comparative determinations of the P_H in the soil by these two methods, which agree very well. The authors further compare the colorimetrical P_H determination with the electrometric, in which the slight deviations from the maximum ± 0.1 P_H show that the use of the colorimetric methods, both according to MICHAELIS and to CLARK and LUBS, fulfil the requirements of scientific exactitude. NIKLAS.

Soil Nitrogen.

RIPPEL, A , Versuche aus dem Nachlass von ALFRED KOCH *Journal für Landwirtschaft*, No. 1, pp. 17-52. Berlin, 1924.

The fundamental conception of KOCH may be summarised as follows : generally speaking, whereas on fallow land it is possible to adopt practical measures in order to increase the fixation of nitrogen by bacteria, it is necessary at the outset to find fallow land which can supply the required amount of energy to the bacteria to enable them to fix the nitrogen, by the utilisation of the organic matter of the soil, although assisted by adequate soil cultivation.

The author is decidedly against this opinion of KOCH's, and considers that the problem of fallow land is only a part of the larger problem, of the nitrogen cycle and its renewal in cultivated soil.

The author has never found that on fallow land nitrogen is assimilated in appreciable quantities.

The author then gives the results of KOCH's experiments on the cultivation in the open field of wheat, rye and meadow-grass. Parallel tests were made on fallow and on cultivated soil, the plots being 3 metres apart. The fertilisers used were potash salts, Chile nitrate and ammonium sulphate. The resulting wheat crop was larger than that of the rye. The yield of grain was proportionately larger than that of straw.

The proportional decrease in quantity of straw was probably due to the gradual production of nutritive elements by the soil, and especially of nitrogen.

In the case of meadow-grass the variations in yield for the different years of the test are larger than in the case of wheat and rye, which is due to the fact that the hay crop depends more than wheat and rye on the year's precipitations.

The average results of the tests for the four years, however, show that the total hay crop is about the same as that of wheat and rye.

Other tests were made by KOCH in metal cylinders with open bottoms. Here it was observed that in the case of wheat the proportion of grain to straw is about the converse of that observed in the yield from the open field. The fertilisers used in this case were potassium nitrate and potassium phosphate.

Other tests were made regarding the action of nitrogen at different depths of the soil, the object of which was to compare soil weathered during the winter and cultivated during the summer with similar, but unweathered soil. The tests were made in pots, with potash salts and superphosphate. The results show how easily the nitrogenous substances in the upper strata of the soil may be made available.

Other tests by KOCH relate to the effect of sugar, cellulose and straw on the nitrogen content of the soil.

The addition of dextrose and cane sugar, continued for a period of 9 years, caused an increase in yield, which increase then stopped at the end of the period mentioned. As regards the addition of cellulose to the soil (in the form of paper), either alone or mixed with manure, KOCH found that cellulose alone tends to decrease the quantity of nitrogen fixed, but when mixed with manure there is no decrease, whereas the quantity is increased by the administration of manure alone. G. B.

The Effect of Fertilizer Salts Treatments on the Composition of Soil Extracts.

SPURWAY, C. H. *Michigan Sta. Tech. Bul.* 45, pp. 18, 1919.

Four sandy loam soils, two acid and two alkaline to litmus paper, were treated with fertilizer salts in the proportion of 1 gm. of fertilizer salt to 1 kg. of soil, placed in a percolation apparatus and leached twice with distilled water, after two days and also after fifteen days standing, with three litres of distilled water at each leaching. Salts used : KCl, commercial acid phosphate, commercial slaked lime, $CaSO_4$, NaCl, $NaNO_3$, $Ca_3(PO_4)_2$, $CaH_4(PO_4)_2$ and $CaCO_3$. The leachings were analyzed for SiO_2 P_2O_5, SO_3, Cl, Ca, Mg, Na, K, Fe_2O_3, Al_2O_3 and combined CO_2. Chemical analyses of the soils are given.

The treatments had certain well defined effects on the soils. Application of soluble chemical compounds to soils change markedly the chemical composition of the soil extracts, and when these soluble constituents are removed the soil is left in a permanently changed condition. The SiO_2 of alkaline soils was found to be more soluble than that of the acid soils. Non-phosphate salt treatments generally increased the amount of phosphorus in the soil extracts. The basic radicals of the salts, KCl, $CaSO_4$, NaCl and $NaNO_3$ occurred in the second leachings in greater quantities than the acid radicals, showing that a transformation had taken place and that these basic radicals were combined with other acids, mainly as carbonates. Comparatively large quantities of iron and aluminium were found in the second leaching from the $CaCO_3$, $NaNO_3$, $CaSO_4$, and phosphate treatments. All treatments except those of slaked lime and $CaCO_3$ left the soils acid to litmus paper. C. H. S.

Studies on the Reactions Between Soils and Various Chemical Compounds.

SPURWAY, C. H. *Michigan Sta. Techn. Bul* 51, p 39, 1921

This work was designed primarily to study reactions between alkaline and acid soils of various classes and neutral salts, bases and hydrolyzing salts.

100 gms. of air-dried soil and 500 cc. of solution containing, usually, one hundredth part of the formula weight of the chemical used, were brought into contact, in glass containers, at laboratory temperature for one hour, and the solution separated from the soil mass by decantation. Soils used: acid and alkaline (litmus paper test) soils of each of the following classes: medium sand, sandy loam, silt loam and clay loam. Chemicals used — KCl, K_2SO_4, KNO_3, $(NH_4)_2SO_4$, $Ca(NO_3)_2$, $CaSO_4$, $CaCl_2$, $MgCl_2$, KOH, $Ca(OH)_2$, K_3PO_4 $CaH_4(PO_4)_2$, $Ca(C_2H_3O_2)_2$, $KC_2H_3O_2$, $K_2C_2O_4$, $FeCl_3$.

The alkaline soils generally fixed greater quantities of the cations of the neutral salts than the acid soils of the same class, but the degree of fixation depends upon certain soil elements,. chiefly calcium and magnesium, with smaller quantities of sodium and potassium, in chemical combinations that react with the neutral salts, and not on the reaction of the soil. Extracting the eight soils with HCl. and washing, greatly reduced the quantities of potassium fixed from KCl by the soils. These soils did not fix equivalent quantities of calcium, potassium and magnesium from neutral salts of these elements. The fixation of potassium was correlated with the exchange of calcium and magnesium from the soils, and the fixation of calcium with the exchange of magnesium, and the fixation of magnesium with the exchange of calcium. The fixation of potassium from KCl by carbonate and non-carbonate soils, was closely correlated with the quantities of calcium and SiO_2 found soluble in 0.2 N HCl. When the acid and alkaline sandy loam soils were saturated with certain cations at equal solution concentrations, then the fixation of the other cations used at the same concentration was closely equivalent. The reactions between soils and neutral salts were reversible in all cases studied. Much greater quantities of calcium were fixed by the soils from $CaCl_2$ after these soils were treated with $MgCl_2$, than before this treatment. These observations contain strong evidence that the reactions involved are of a chemical nature, and that the chief cause of fixation from neutral salts by soils, is the presence of chemical elements in combinations that react with the neutral salts, forming an insoluble compound with the salt cation and some soil acid; and the degree of fixation is considered to be dependent upon both kind and quantity of the reacting ions present

Potassium and calcium were fixed from hydroxides in large quantities by all the soils used without equivalent exchange of soil elements; but a portion, at least, of the potassium and calcium fixed from hydroxides is held by the soils in an exchangeable condition

In general, the alkaline soils fixed greater quantities of the basic ions of hydrolyzing salts used than the acid soils, but a greater degree of fixation was observed from the hydrolyzing salts than from the neutral salts. The fixation of one ion of an alkaline hydrolyzing salt was apparently independent of the fixation or combination of the other ions of the same salt. In the case of $FeCl_3$, the iron fixed by the soils was nearly proportional to the calcium found in the soil extracts, showing that this reaction is mainly neutralization of the HCl produced and precipitation of iron as $Fe(OH)_3$.

Anions or acid radicals of the salts used that form insoluble compounds with calcium and magnesium were fixed by the soils, but anions of salts that form soluble compounds with calcium and magnesium are not fixed by soils, at least not to any great extent

Coarse particles of limestone may be present in soils where the fine material may be acid.

Fixation of basic ions or elements from salts, is not a distinguishing characteristic of acid soils.

The reaction between soils and chemical compounds, especially with reference to products found and soil fixation, depends chiefly upon the manner of dissociation of the compounds used for the treatments and the solubilities of the possible combinations. The magnitude of the reaction depends upon the quantity relationship between the reacting compounds.

C H. S.

Studies on Active Bases and Excess Acids in Mineral Soils.

SPURWAY, G H, *Michigan Sta. Tech Bul.* 57, pp 27, 1922.

The object of this research was to determine the neutralizing value of soils for acids and alkalis, using the hydrogen electrode as the end-point indicator. In the titration work, 10 gms. of soil were placed into each of several beakers, the number depending upon the range to be covered: 0.1 N equivalents of the different reagents used were added in quantities of one to 10 cc. and sufficient neutral, distilled water was added to each beaker to raise the liquid volume to 50 cc. Soils used: — medium sand, sandy loam, silt loam, clay loam and a miscellaneous series of soils. Reagents used: $Ca(OH)_2$, Al_2Cl_6 and HCl.

The neutralizing value of soils for acids and alkalis may be quite accurately determined and methods are given for this purpose. When soils are treated with $Ca(OH)_2$ the reaction proceeds slowly and comes to an equilibrium on P_H 7.00 with the quantity of $Ca(OH)_2$ required in at least 24 hours, but in the presence of an excess of $Ca(OH)_2$ an equilibrium was not obtained in three to eight days, indicating that this further reaction continues for a long period of time. $Ca(OH)_2$ forms salts with soil acids. A soil acid equilibrium may be obtained in about three hours in the presence of an excess of the acid, and this equilibrium is quite constant over a period of several days, showing that a rather sharp distinction may be made between reactive and inactive soil bases. Weak soil acids are split off when soils are heated with strong acids. There is a direct correlation between the base-acid ratio of soils and P_H This base-acid ratio in soils is believed to be of great scientific and practical importance.

C. H. S.

The Decomposition of Organic Matter in Soils.

STARKEY, R. L. (New Jersey Agricultural Experiment Station) *Soil Science*, Vol XVII, No 4, pp 293-311; 7 tables, figs 5, bibliography Baltimore, Md., 1924

The author has investigated the decomposition of cellulose, dextrose, rice straw, alfalfa, dried blood, and a mixture of mycelium and fungus spores, in one and the same soil and in different soils, measuring the intensity of decomposition by the formation of carbonic anhydride. It was found that, in spite of what has been said to the contrary, this method is a good index of decomposition.

In the same soil, decomposition varies according to the various substances contained therein, and is very rapid in fertile soils After two days, the following were eliminated as carbonic anhydride . 35 % of the dextrose carbon, 26 % of the alfalfa, 19 % of the mixture of fungi, 16 % of the rice straw, 7 % of the dried blood and 0.5 % of the cellulose. Decomposition attains its maximum during the first few days.

The speed of decomposition varies according to the substances ; the slowest is cellulose ; then follow rice straw, alfalfa, fungus mixture, and dried blood ; glucose is the most rapid of all.

Nitrates accelerate the decomposition of rice straw and cellulose, but have no effect on alfalfa. Rice straw tends to diminish the soluble nitrogen of the soil, whereas alfalfa and dried blood increase it.

Fertile, and almost neutral soils in general, decompose the organic matter more quickly than the less productive and the acid soils. The differences in the power of decomposition among the various soils, however, are not very great.

A. F.

Methods of Studying Soil Acidity.

TIDMORE J W and PARKER F W (Alabama Polytechnic Institute). Methods of Studying the Strength of Soils Acids *Soil Science*, Vol XVIII, No 4, pp 331-338 Baltimore, Md, 1924

The three methods: TRUOG's acidity, sugar inversion, and hydrogen-ion concentration, give similar results, which proves that the hydrogen-ion concentration in soil solutions is to a great extent caused by the acidity of acid silicates

By maintaining a constant specific resistence and hydrogen-ion concentration, the presence of acid soils greatly increases the sugar hydrolysis, without the influence of the solid phase being observed. Probably it is a question of a hydrogen-ion concentration greater at the surface of the soil particle than in the solution. A. F.

Investigations on the Changes in Soil Solutions during the Plant-Growth Period on various Ploughed Fallow Soils.

TROFIMOFF, A W *Journal fur landwirtschaftliche Wissenschaft*, No 9-10. State Technical Publishers, Moscow, 1924

The author has obtained soil solutions from various parts of the experimental field of the Moscow Agricultural Academy during a dry and a moist period of plant growth, by Prof. A. G. DOJARENKO's "petroleum-emulsion method", and subjected them to a careful chemico-physical test by the same experimental method The chief results may be summarised as follows:

(1) The concentration of the soil solution increases until the middle of the growth period, and decreases again towards the end On absolutely fallow land the concentration is three times stronger than on recently ploughed land

(2) The osmotic pressure, which is likewise 4-5 times greater on purely fallow land than on that recently ploughed, also attains its maximum during the growth period.

(3) The nitrogen content of the nitrate is likewise at its highest in the middle of the summer, and greater in purely fallow land than in recently ploughed land.

(4) The relative K, Mg and Ca content is equalised and causes a "buffering" of the soil.

(5) Anions are in excess of cations

(6) The hydrogen-ion concentration was in all cases nearly neutral and was only occasionally inclined towards acidification, but always within the optimum limits for plant life GOERNER

Soil Colloids, their Action on Lime and Bicarbonate of Lime.

VINCENT, V (Quimper) Emploi rationnel de la chaux et du calcaire dans les sols argileux ou acides. *Association française pour l'Avancement des Sciences* Congrès de Bordeaux, 1923, pp 1023-1025, published at Paris, 1924

The combination of lime (CaO) with alumina (Al_2O_3) forms an insoluble tricalcic aluminate; with gelatinous silica (SiO_2) an insoluble tricalcic silicate ; and with ferric hydrate there is no combination, but adsorption.

As regards the organic matter of the soil, there is a formation of humate with the acid part and a calcic combination with the nitrogenous hydrocarbon remaining, which may fix at the most 10 % of its weight of CaO.

In some soils, the proportion of CaO fixed per kg. of soil is 20 grams, whereas if calcium bicarbonate be applied the soil only retains 3 grams of CaO.

In the Brittany granite soils, the acidity determined by calcium bicarbonate is due almost entirely to the organic matter and not to alumina.

In practice, VINCENT advises the following applications. lime, to precipitate the colloids of a clay soil and thus make it easy to till and permeable to water , limestone (carbonate of lime) to neutralise the acidity of a humous soil.

Soils are alkaline when the ratio : lime soluble in acetic acid . 1 % organic matter is about 9 %

To Brittany soils of average richness in organic matter (30-40 grams per kg. of soil), 1200 kgs. of pure carbonate of lime, or its equivalent of 570 kgs of lime, should be applied annually

Dr PIERRE LARUE.

Effects of Lime on Decomposition of Soil Organic Matter.

WHITE J. W. and HOLDEN F. J. (Department of Agronomy, Pennsylvania State College) *Soil Science*, Vol XVIII, No 3, pp 201-218, 1 bibliography Baltimore, Md , 1924

The experience of forty years shows that there are no fundamental differences between the action of quicklime and that of crushed limestone on soil organic matter. Both substances, applied in quantities eight times greater than that used for calcareous soils, gave a considerable increase in nitrogen over that in soils not treated There is no sign whatever of any destruction of organic matter by the quicklime, as might have been feared Indeed there is a greater preservation of nitrogen and organic matter with lime (in the form of quicklime or limestone) than in soil not treated. A F.

Method for Testing Artificial Fertilisers.

(*Methode zur Untersuchung der Kunstdüngemittel*) Compiled and published by the German Fertiliser Manufacturers' Association (" Verein Deutscher Düngerfabrikanten "). VI. Edition. Publ by F Vieweg, Son & Co , Brunswick, 1925

A laboratory book for chemists engaged in testing fertilisers.

SCH.

Biological Properties of Soils.

The Protozoan Fauna of the Soils of the United States.

ALLISON R. V. (Rothamsted Experiment Station). *Soil Science*, Vol. XVIII No. 5, pp. 339-352, 1 fig. bibl. Baltimore, M., 1924.

The examination of a series of soil samples taken in various parts of the United States shows considerable uniformity in the distribution of the more important flagellates, ciliates and rhizopods. *Heteromita* sp., *Cercomonas* spp. and *Cicomonas* sp. were found in all of them; *Dimastigamoeba gruberi* in 95 %; and *Sainouron* in 65%. In general, the types of genera were similar to those met with in England.

As regards the quantity of protozoa present, on the contrary, the author obtained rather low figures as compared with those obtained in England, the ciliates especially were scarce or absent The maximum number of flagellates was 10,314 and the minimum 15; and the amoebae varied from 3,114 to 22 In some cases, all, or almost all the protozoa were found in the cyst stage.

The following conclusions may be drawn: It is considered that the protozoa cannot act as a limiting factor, especially in conditions of partial sterilisation. Now, following on the author's investigations, the query may arise as to whether this depends, not on the lack of the capacity of the protozoa themselves to act as a limiting factor, but rather on their limited numbers, owing to which they can exert no decisive influence A. F

The Density of Unicellular Organisms.

ALLISON R. V. *Annals of Applied Biology*, XI, pp. 153-168. 1924.

When it is desirable to calculate the total mass of the micro-organic population of soil or other media, a knowledge of the density of cells, calculated from numbers and dimensions, is important. The author measures the rate of fall of unicellular green Algae (*Scenedesmus* sp.) in water and calculates the density therefrom by the formula of STOKES The mean density of that organism was found to range between 1.07 and 1.15. The density of certain unicellular animals is also reported. By applying the formula of HEHNER and RICHMOND to the values for density, the percentage of dry matter has been calculated P. H. H. GRAY.

The Action of Protozoa on Bacteria when Inoculated into Sterile Soil.

CUTLER, D W, *Annals of Applied Biology*, X. pp 137-141, 1923

Proof that Protozoa are normal agents that keep down bacterial numbers in field soil is adduced in an experiment lasting 21 days wherein soil sterilised by intermittent steam is inoculated with:

(*a*) Bacteria alone;
(*b*) Bacteria and a species of Amoeba;

(*c*) Bacteria and a species of Flagellate, with the following results:

(*a*) Bacteria alone rose to 214 millions per gramme on the 6th day and maintained a level of 160-135 millions from 8-21 days.

(*b*) Bacteria with amoebae present rose to 177 millions at the 3rd day and fell to 66 millions on the 8th day, fluctuating between 70 and 30 millions up to the 21st day.

(*c*) Bacteria with flagellates present rose to 100 millions on the 7th day, fell to 50 millions on the 16th day, and fluctuated between 40 and 70 millions up to the 21st day.

Protozoa were in the active (trophic) form during the 15th 21st days of the experiment; the normal relationship between them and the bacteria thus appears to have been maintained.

P. H. H. Gray.

A Quantitative Investigation of the Bacterial and Protozoan Population of the Soil, with an Account of the Protozoan Fauna.

Cutler, D. W., Lettice M. Crump, and H. Sandon. *Phil. Trans. Roy. Soc. Lond.* Ser. B. Vol. 211, pp. 317-349, 1922.

The results are given of 365 consecutive counts made daily, from July 5th 1920 to July 4th 1921 of the numbers of bacteria and of six species of protozoa in a normal field soil. The soil samples, consisting of a mixture of six cores 9'' deep, were taken from an experimental plot that annually receives 14 tons of dung per acre, two feet, separating adjacent cores so that variations in numbers of micro-organisms due to unequal distribution might be avoided. The bacteria and protozoa were counted by dilution methods, which are described, using Thornton's count medium for the former, and Cutler's technique for the protozoa. A summary of the complete data obtained is given in tabular form.

Both the bacteria and the protozoa were found to fluctuate greatly from day to day; these fluctuations could not be correlated with meteorological or soils conditions. Seasonal changes in the soil micro-organic population are found to exist in addition to daily variations in numbers. Both bacteria and protozoa were at their maximum at the end of November, and at a minimum during February. Temperature and rainfall were not found directly to influence these seasonal changes. A comparison is made between these seasonal fluctuations in field soil and similar changes occuring in aquatic organisms.

An inverse relationship was found to exist between the numbers of bacteria and active (trophic) amoebae in 86 % of the total observations. A two-day periodicity, more marked in March than in July 1921, was shown for the active forms of one species of soil flagellate, *Oicomonas termo*. Auto-intoxication is suggested as a possible cause for this periodicity at certain times of the year, but not for the whole period under observation.

P. H. Gray.

On the Partial Sterilisation of Peat.

DEMOLON, A (Laon) Association française pour l'Avancement des Sciences. Congrès de Bordeaux, 1923 Published in Paris, 1924, pp 1025-1026.

Peat, after being heated for a quarter of an hour at 100°C, instead of a partial sterilisation of its microbic reactions, shows a super-activity in the form of an increased discharge of carbonic anhydride.

Why is peat passive in its natural state (before heating)?

The following are the results of M. DOLOMON'S experiments.

1. The liquid with which the peat is impregnated contains no substances which obstruct microbial development.

2. Chemical antiseptics such as carbon disulphide, toluene and naphthaline remain inactive

3 After boiling a culture, the microbial phenomena are intensified.

4 The acid reaction of peat in chalky soil is $P_H = 6.4$ to 6.8. No neutralisation takes place

It is concluded that the poorness of the mass in nutrient elements prevents reaction in peat

The results of heating are

(*a*) The formation of ammonia in the cores of soil;

(*b*) the increased solubility of the mineral substances (0 30 gms. to 1.20 gms), among which phosphoric anhydride (P_2O_5) and potash (K_2O) become soluble

The addition of mineral fertilisers is therefore a primary condition for rendering peat soils productive PIERRE LARUE.

The Influence of Nitrifying Bacteria on the Growth of Barley.

FRED, E B (University of Wisconsin) *Soil Science*, Vol XVIII, No 4, pp 323-330, figs 2 Baltimore, Md, 1924

Growth tests on SHIVE solution, in which calcium nitrate was substituted by ammonium sulphate In some of the pots a culture of nitrifying bacteria was added The yield of barley in the pots to which the nitrifying bacteria were added was almost double that of the check. The beneficial influence of such bacteria is therefore proved A F.

Nitrification in South African Soils.

HALL, T. D (School of Agriculture and Experiment Station, Potschefstroom) *Soil Science*, Vol XVIII, No 3, pp 219-235, bibl Baltimore, Md, 1924

The author continues his investigations on the nitrifying power of 30 soils in the Transvaal, the partial results of which were published in this *Review* (Vol XII, No. 4), and has now been enabled to draw the following general conclusions:

The factors which influence nitrification in the climatic conditions observed by the author, more than the temperature, are moisture and aeration. The seasonal changes show that there is a production of nitrate which would be sufficient for the majority of the crops in such types of soil, and this explains the small effects obtained with nitrate fertilisers.

It appears that the drying of the soil in the winter season, and the frosts also, increase the nitrifying power when conditions become favourable again for nitrification. Nitrification is scarce in samples taken at a depth of about 30 cm. and is almost nil at a depth of 1.80 m.

In acid soils also nitrification is good and not improved by the addition of lime. It was also satisfactory, except in two cases, in soils under tobacco, in which the subsoil nitrifies better than the surface soil.

A. F.

Investigations on Azotobacter.

NIEMEYER L. Azotobacter Studien *Botanisches Archiv*, Vol VII, Parts 5-6. Königsberg, 1924.

The author's investigations are divided into two parts. In the first the problem is considered from the ecological and the botanical-geographical point of view. The subject of these preliminary investigations is the diffusion of *Azotobacter* in the various soils and the conditions necessary for its development. In the second part the problem is considered from the morphological point of view and its historical development.

The presence of *Azotobacter* in soil is mostly influenced by the aeration and chemical reaction of the soil. *Azotobacter* was found in 54 % of the soils analysed, the acidity of which was determined by the WHERRY method.

The limit of soil acidity concomitant with the presence of *Azotobacter* was found by the author to be P_H 5, whereas that of alkalinity could not be determined in the soils examined.

Azotobacter was found in 74 % of cultivated soils. Those in which it was impossible to detect the presence of *Azotobacter* all showed less than P_H 5.5 of acidity.

The difference in percentages as regards uncultivated and cultivated soils respectively, is due to the fact that among the first some showed clearly acid reactions, and others, though from a biochemical point of view fulfill the conditions necessary for the development of *Azotobacter*, were found to be insufficiently aerated. Tilled soils are aerated by ploughing and only in exceptional cases do they show acid reaction.

Azotobacter was also found in roads ; newly formed fields may therefore be easily infected. *Azotobacter* was likewise found in the Islands of Juist and Heligoland, as well as in the waters of the North Sea, some yards from the shore (Juist Island).

As regards morphology and the history of the development of *Azotobacter*, the experimental material was supplied by two species from Muenster and Juist; they presented no appreciable morphological difference. The pigmentary formation was found to be more marked in the Juist than in the Muenster species. In neither case was it possible to establish any relation between the lime content of the soil and the formation of the pigment.

In the Muenster cultures, cells free from glycogen were observed, these cells having appendices of rod-like from, which, as regards colouring matter and reagents, behaved like the cells themselves. No further development of such formations was observed and their importance seems doubtful

In the works of LÖHNIS and SMITH *Azotobacter* is studied under several forms, which may be classified in 3 distinct groups : (1) Developed forms ; (2) Regenerated forms , (3) Symplastic and combined forms.

A. F.

Bacteria which fix Nitrogen in Vesuvian Soils.

RICCARDO, S. (Institute of Agricultural Bacteriology in the Royal Higher School of Agriculture, Portici) First contribution to the knowledge of bacteria which fix nitrogen in Vesuvian soils. *Annali della R Scuola sup di agricoltura in Portici*, Series II, Vol XVIII, pp 1-50, figs 3, bibliography Portici, 1923.

The object of this work is to examine the result of a successive application of schizomycetic species in Vesuvian virgin and sterile soils before the growth of algae, lichens and mosses. From the results, on the completion of the investigation, it will be possible to determine whether or not there exists a succession of those pre-eminently agricultural processes (putrefaction, nitrification, denitrification, fixation of nitrogen) and also whether there are soils in which such process do not take place.

In the Vesuvian plain soils, besides *B. amylobacter*, there are many rounded forms which must in all probability be classed with the so-called nitro-bacteria , on the other hand the nitrogen fixers are absent or extremely rare at a height of 310 m and also of 878 m.

Six species of nitrogen fixers were isolated , one of these, an anaerobe, corresponds to *B. amylobacter*, hence it may be concluded that the anaero-nitro-bacteria come within the group of such bacteria ; investigations must be made however in order to discover whether the other types isolated at various heights are in every respect identical with the type isolated on the said plain and heights.

Among the other species having the common quality of fixing nitrogen and of being aerobic, three belong to the schizomycetes and two, most probably, to the *Mycoderma* genus. The systematic position of these species and the relations between them and those considered as belonging to the *Azotobacter* genus will form the object of further research.

A. F.

The Streptotriceae of Vesuvian Soils.

RICCARDO, S (Institute of Agricultural Bacteriology, Royal Higher School of Agriculture, Portici) *Annali della R Scuola sup di Agricoltura in Portici*, Series II, Vol XVIII, pp 1-13 Portici, 1923

In the Vesuvian soils which were most affected by the action of the cinders of the 1906 eruption, the streptotriceae are not numerically great.

The author has isolated a species which may be considered to be *Actinomyces chromogenes Gasparini albus* L., e. N

It has no pathogenical power but seems to have a certain capacity to fix nitrogen. A. F.

Some Protozoa from Soils Collected by the "Quest Expedition" (1921-1922).

SANDON, H., and CUTLER, D. W. *Journal Linnean Society Zoology* XXXVI, pp 1-13, 1924

Soils collected from widely distributed localities in the Atlantic Ocean, (St. Paul's Rocks, South Georgia, St Vincent, Elephant Island, Tristan da Cunha, Gough Island, St. Helena and San Miguel, Azores) were found to contain types of Protozoa mostly identical with those found in English soil and soils from other parts of the world. The soils which had been cultivated for many years contained the richest protozoan fauna. A total of 92 species were identified. P. H. H. GRAY

On the Development of a Standardised Agar Medium for counting Soil Bacteria.

THORNTON, H. E., *Annals of Applied Biology*, IX pp 241-247 1922

In order to make an accurate estimate of fluctuations in the numbers of soil bacteria, a medium is required which will give constant results, be reproducible at different times or by other workers, and allow in a single soil suspension the development of numbers differing only within the limits of random sampling variance. This constancy in results with a plating medium depends mainly upon the following factors

A The composition of the medium must be constant

B There must be little interference between developing colonies, *e g* rapidly spreading colonies must be checked

C The growth of fungi must be kept down

D There should be only slight variation in hydrogen-ion concentration. Reproducibility has been obtained for the medium by the use of pure chemical compounds and such constituents as will not change appreciably the reaction in an agar substrate. The medium here developed also represses the rapid growth of *B dendroides* over the surface of the agar by reducing its rate of multiplication, and the development of fungi is considerably checked

The medium has the following composition

K_2HPO_4	1 00 gm	KNO_3	0 5 gm
$MgSO_4 7H_2O$	0 20 »	Asparagine	0 5 »
$CaCl_2$	0 10 »	Mannitol .	1 0 »
NaCl	0 10 »	Agar . .	12 0 »
$FeCl_3$	0 02 »	H_2O to	1000 cc

The method of its preparation can be carefully standardised in order to produce comparative results. The following technique was finally adopted. The K_2HPO_4, KNO_3, and asparagine are dissolved in distilled water; the $MgSO_4$, $CaCl_2$, NaCl and $FeCl_3$ added from standard solutions in the order named. The agar is then added and dissolved in the steamer at 100°C.

At this temperature the medium is filtered by passing it twice through a layer of cotton wool. To the filtrate the mannitol is added: at 60°C. the reaction is adjusted to P_H 7.4 with Brom-Thymol Blue, and the tubed medium is sterilised for 15 minutes at 15 pounds pressure. The optimum temperature and time for incubation with this medium is found to be 20°C. for 10 or 12 days. P H. H. GRAY.

Soils and Vegetation

Deficiency in Nitrate caused by the application of Wood Waste.

ARRHENIUS, O, Ett fall av nitratbrist åstadkommen genom inblandning av traavfall Medd 276 från Centralanstalten for jordbruksforsok

The author describes an instance of a market garden which was completely ruined by a " compost " of wood shavings. Cucumbers, tomatoes, lettuce, strawberries, etc, showed evident signs of deficiency in nitrate and finally perished

An application of nitrate fertiliser prevents this result. Frequent dressing with nitrate in solution is suggested. A.

Soil Reaction and Yield.

ARRHENIUS, O Markreaktion och skordeutbyte Medd 278 från Centralanstalten for jordbruksforsok

The author shows that the various cultivated crops have different requirements as regards soil reaction. Various growths of the same species of plant even may show differences That the results of the pot-tests are also applicable to field crops is proved by field tests.

The author proposes the following methods for utilising to the utmost the results obtained

(1) To cultivate those plants which respond to soil reaction,

(2) In special cases to adapt soil reaction to the plants it is desired to cultivate,

(3) As a third possibility it is proposed to use various kinds of plants on different types of acid soils. A.

Recent Investigations regarding the Utility of Stable Manure Nitrogen in Field Soils.

BARTHEL, Chr Nyare undersokningar rorande stallgodselkvavets utnyttjande i åkerjorden *K Lantbruks Akad Handl o Tidskr* 1925

The author refers to earlier observations, and shows that the increase in the number of micro-organisms, which should result from stable manuring, probably has no influence on the microflora of the soil, for the proportion of the microflora is generally already established.

The author would therefore attribute to stable manure not a direct, but an indirect biological influence.

Tests made at the Swedish Central Agricultural Station show that the ammoniacal nitrogen in stable manure is nitrified during the first year. The organic nitrogen on the other hand dissolves very slowly, as was proved by tests with stable manure freed from ammonia. Stable manure therefore is a very important source of nitrification only during the first year.

For decomposing cellulose, ammoniacal nitrogen is of much greater importance, as was shown by BARTHEL and BENGTSSON. This therefore is another indirect influence of stable manure and not, as was formerly believed, an accelerated decomposition of cellulose through the importation of cellulose-fermenting organisms. A.

Soil Acidity and its Relation to Ammonification and Nitrification of Woodland Soils.

CLARKE, H R (*Oxford Forestry Memoir No. 2*) *The Indian Forester*, Vol. L, No. II, pp. 580-593. Dehra Dun, U. P., India, 1924.

The close relation between the plant and its habitat is well known and that the reaction of the soil is an important factor in plant distribution, the growth of each type of plant being most successful within a specific reaction.

The total acidity of a soil is a quantity factor, measured by the amount of the base required to combine with the whole amount of acid present. The active acidity of the soil, the concentration of hydrogen-ions, is, on the other hand, a measure of the intensity factor of soil acidity.

In correlation between soil types and forest types and plant associations, the activity of the microflora of the soil is a significant factor. The organisms which bring about ammonification and nitrification are of great importance, and a study of these bacteria with regard to hydrogen-ion concentration is of value.

The author in his studies employed GILLESPIE's method for estimations of hydrion concentration, and HUTCHINSON and McLENNAN's to determine the lime requirement. The estimation of ammonia was made by MATTHEW's method, and the determination of nitrates by means of phenoldisulphonic acid.

A definite relationship was found between the lime requirement of a soil and its organic content. The pH value of a soil growing a forest is least acid when the forest is in full growth. The accumulation of ammonia is greater in very acid soils than in slightly acid or neutral soils. The ammonia of a very acid soil is liable to rapid fluctuation. Nitrate is present in measurable quantities in very acid soils and is apparently independent of reasonal changes, under the conditions of the author's investigations, in which the soils studied were taken from woodland.

W. S. G.

The Effect on Crop Yield of Mixing Light Sandy Soil with Meadow Marl, Low Moor and Clay Soils.

GERLACH, *Landw. Jahrbücher*, Vol. 61, p. 153. Berlin, 1925

The author's investigation on this subject in Mocheln and Bromberg showed that in general the very beneficial influence of meadow marl, clay and low moor soil on unfertilised plots is greater than on fertilised. On the other hand the deleterious effect of an admixture frequently becomes very evident, especially on unfertilised plots. The advantage of such mixing, from results obtained in Mocheln, seems somewhat doubtful, but the results obtained in Bromberg were rather more favourable By the use of clay and low moor soil the deposit seems to be improved, yet the result in this direction are not uniform. Meadow marl, clay and low moor soil should act directly as a fertiliser on the light sandy soil, poor in nutrient substances. It must also be considered that soil reaction is greatly influenced by these additions.

In any case, only after the question of the advantage of the process has been proved, can it be decided whether, and to what extent, the admixture of certain substances to a sandy soil is advisable.

NIKLAS.

Effect of Salts on the Intake of Inorganic Elements by the Plant.

HOAGLAND, D. R. and MARTIN, J. C. *University of California, College of Agriculture, Technical Paper No 8*, pp 26, tables 7, figs. 5, bibliography Berkeley, Cal., 1924.

The authors carried out a series of experiments to study the effect of alkali soils or solutions on the chemical system of the plant, in order to obtain a better understanding of the relation of the plant to the medium in which it grows. The experiments were made on barley, beans, peas and pumpkins. Attention is drawn to the variation of the effects of salts on plants according to environment, temperature, humidity, etc.

Sodium chloride and sodium sulphate tended to decrease the absorption of calcium, magnesium and potassium. When sodium chloride is used, sodium and chlorine may be absorbed and stored by the barley plant in relatively large quantities In the case of sodium sulphate, the sulphate ion is removed less rapidly from solutiont han the chlorine ion, this is true for barley, cucumber and melons.

Observations were made on the effect of salts on the reaction and buffer systems of barley, peas and pumpkins. Rapid and extreme changes in the reaction of the sap expressed from the roots were caused by the addition of sodium bicarbonate to the culture solution. Calcium chloride produced changes in the reaction and buffer effect of the plant juices. Barley and pumpkins were influenced in opposite directions. Neutral sodium salts caused slight changes in reaction and titration values. Sodium nitrate increased the alkalinity of the root sap, with accompanying injury similar to that induced by sodium bicarbonate.

A brief general discussion of certain phases of alkali injury to plants is given. W. S. G.

The Natural Increase of Metal Salts and other Inorganic Compounds in Plants.

Von LINSTOW, O , *Die naturliche Anreicherung von Metallsalzen und anderen anorganischen Verbindungen in den Pflanzen* Verlag des Repertoriums, Berlin-Dahlem, Fabeckstrasse, 49, 150 pp , 1924

This work reviews the plants which are associated more or less to a soil of a definite chemical composition, or at least prefer such a soil, and further indicates those plants which are enabled to draw from or to increase one or more of the constituents of such a soil. SCHUCHT.

The Effects of Additions of Nitrogen, Phosporus and Potassium on Nitrogen Economy.

MORRIS V H (Ohio Agricultural Experiment Station) *Soil Science*, Vol XVIII, No 2, pp 87-97, bibl Baltimore Md , 1924

Nitrogen is one of the most important plant constituents, it is the most costly, and is also easily lost in leaching Hence the great utility of investigations directed towards preserving the nitrogen left in the soil, and the most scientific method of its application

Tests covering a period of 30 years in a fine sand and silt soil, with quinquennial rotations of maize, oats, wheat, clover and *Phleum pratense*, have shown an average loss of 22 % of the original supply of nitrogen Plots treated with lime lost similar quantities of nitrogen to those which were not treated ; in the last 10 years the loss was greater even, in those treated.

The use of fertilisers (potassium chloride and acid phosphates) resulted in a preservation of nitrogen directly proportional to the increased yield due to the fertilisers themselves. In this case the lime increased the quantity of nitrogen preserved bv applications of fertiliser A F

A Critical Enquiry into the Alleged Fixation of Nitrogen by Green Algae.

BRISTOL MURIEL, B and PAGE, H J , *Annals of Applied Biology*. X, 378-408, 1923

WANN's conclusions that Green Algae were capable of assimilating free nitrogen from the air in the presence of nitrates and glucose, were tested with pure cultures of four species of Green Algae under conditions almost identical with those used by WANN (*Amer. Journ. Bot.* VIII, 1-29, 1921). The method of chemical analysis used by WANN for media containing nitrates is shown to be faulty, and the probable source of error is indicated.

In this experiment the average percentage recovery of nitrogen was or the cultures 99.28 per cent., and for the controls 99.25 per cent.

P. H. H. GRAY

Relation of Soil Moisture and Available Nitrogen to the Yield and Protein Content of Wheat.

Neidig A. E. and Snyder R. S. (Idaho Agricultural Experiment Station). *Soil Science*, Vol. XVIII, No. 3, pp. 173-179. Baltimore, Md., 1924.

The results of the authors' previous investigations were that, moisture is the chief factor in wheat production and also as regards protein content, provided that sufficient nitrogen is available. The present investigations prove that a high percentage of moisture in a soil containing sufficient available nitrogen, gives an abundant wheat yield with a high protein content. If on the other hand, under the same conditions, the moisture is deficient, there is a lower yield, but with a still higher protein content. This last factor may be attributed to grain shrinkage.

If, with good moisture conditions, the nitrogen is insufficient during the period of heading and ripening, but high during the first periods, there is an abundant yield with a low protein content. If, on the other hand, while nitrogen remains the same, the moisture is deficient, the yield is low and the protein content varies with the amount of grain shrinkage.

Under natural conditions, abundant rains evenly distributed over the growth period, with an average soil, give a high yield with a low protein content ; in the same conditions, with a very fertile soil, there is a high protein content if the nitrogen was available throughout the life cycle of the plant. A soil in which wheat is continually grown produces a larger yield of grain when rains are plentiful, especially if these are scarce during the heading and ripening period. In general to obtain an abundant yield of good quality, suitable conditions as to soil moisture and high fertility are necessary

A. F.

The Importance to Plants of Nutritious Soil Substances with Interchangeable Bases and the Influence of Lime on Absorbent Soil Substances.

Nostitz, A., *Landw Versuchsstationen*, 103, 159, 1925.

The author's investigations led to the conclusion that when an interchange of bases is impossible, the nutrient substances combined with bases can only assist the roots by attacking the absorption agents, whereby at the same time the absorptive power of the soil is weakened. This reaction proceeds rather quickly so long as zeolitic substances saturated with bases are present, but this easily attackable part is small. In field soils there are scarcely any aluminium silicates combined with bases available, hence without an interchange of bases the available absorbent nutrient substances of the soil are not sufficient to ensure abundant nutrition. A corresponding carbonic acid-lime content of the soil acts as a buffer, in the sense that it prevents the decomposition of the zeolitic aluminium salts containing water, and thereby the soil's power of absorption is better ensured.

Niklas.

Injury caused to Plants by Mixing Sawdust with the Soil.

SOEDERBAUM, H G , and BARTHEL, Chr Inverkan på vaxtligheten av träavfall i jorden. *Medd* 271 från Centralanstalten för försöksväsendet på jordbruksområdet

During the war, sawdust was generally used as a stable-litter , it is still so used to a great extent in the sawmill districts of Sweden.

The authors show that arrest in plant growth took place through applying sawdust to sandy soil, 2 % of cellulose completely stopping the nitrification of an otherwise normally nitrifying soil This stoppage was of long duration. It is not caused by resins or similar substances, but is more probably due to the capacity of cellulose compounds to use up the nitrates.

If the cellulose in the soil is destroyed nitrification is resumed.

The arrested growth phenomena can be eliminated by the use of a nitrate fertiliser. A

Nomenclature, Classification and Mapping.

The Importance of Soil Maps in Agriculture.

NIKLAS, H , *Illustrierte landw Zeitung*, 45, 37, 1925

After describing the development of soil-mapping in various countries, the author points to the importance in practical agriculture of representing the soil on a strictly scientific basis, especially as regards the estimation of soil and agricultural statistics, in which connection the author refers to his own extensive works on this subject H NIKLAS

The Foundation of Soil Mapping.

TILL, ALFRED, Vienna With 2 sketch-maps in the text pp 95, Publ by L W Seidel u Sohn, Vienna, 1923

The author divides soil science into analytical, dynamic and geographical pedology, and in this booklet treats of the importance and utility of soil-mapping. The work should lay the foundations for the beginning of soil-mapping in Austria. Contents The search for a Natural Soil System , Classification of Soils , Soil-Mapping. SCHUCHT.

Synoptic Agropedological Map of the Czechoslovakian Republic.

Drawn by Prof J KOPECKY and Eng J SPIRHANZL Prague, 1924.

Dividing the soils of the Czecho-Slovakian Republic according to texture into 8 types, the authors have drawn up a clear soil map, 100 × 48 cm. (explanations in Czek and French). The soil types are ·

(1) Heaviest clay soils ;
(2) Heavy clay silt soils ;
(3) Cohesive sand-clay soils ;
(4) Ordinary silts ;
(5) Friable sandy silts ;
(6) Silty and humous sands, easily disaggregated ;

(7) The lightest quicksands ;
(8) Shallow stony soils, covered with forests.

This map is very useful to persons tudyingthe Czechoslovakian soils.

L. SMOLÍK.

Regional Soil Science.

Investigation of Soil Strata in White Russia.

AFANASSIEW, A. *Zeitschrift des landwirtschaftlichen Instituts Gorky.* Vol II, 1924 (*Journal of the Gorky Agricultural Institute*)

The author reviews the soil types which go to make up the soil of White Russia, and the history of their formation during the Diluvial and Alluvial Periods. The results are summarised in the following general review of the soil strata

I. Upper layer Gravelly sand and sand without gravel (1 m.) ; or loamy sand (1 m.) ; or loess loam (0.30-1 m.) ; or loess (10 m.) ; or loam without gravel (up to 0.05 m.)

II Middle layer : Gravelly coarse sand (0.1-1 m.).

III. Subsoil · Moraines, the upper sections of which contain gravel, or, in the neighbourhood of loess, humus formations (0.5-1 m.). At Gorky there are two, and at Vitebsk three moraines, one over the other, which are divided by 12-15 m. of very coarse sand. HELLMERS.

The Composition of some Sudan Soils.

JOSEPH, Dr A. F (Wellcome Tropical Research Laboratories, Khartoum). *Journal of Agricultural Research*, Vol XIV, Part 4, pp 490 497, tables 5, bibliography London, 1924

The article records the mechanical and chemical composition of some typical soils of the Sudan, e g (*a*) river flood alluvium brought down from the Abyssinian hills by rapid rivers and deposited in certain parts of the eastern Sudan ; (*b*) " Badob ", loess or cotton soil, an important area of which is the " Gezira " lying between the Blue and White Niles ; (*c*) Khor Soils, deposited in the beds of streams running only in the rainy season ; (*d*) Goz soils, reddish in colour and with a high percentage of sand and a clay content of 5 to 50 % ; (*e*) Blue clay soils, found in the upper reaches of the White Nile, and which may contain as much as 75 % clay.

None of the above types are common in temperate climates , they appear to be associated with large uniform plains having only the gentlest slopes. They are all alkaline and the organic matter rarely exceeds 1 % ; nitrogen is usually less than 0.05 %, phosphoric oxide extracted by 20 %, boiling hydrochloric acid varies between 0.1 and 0.2 %, in samples from the first foot of soil.

The Gezira badob soil alone contains particles above 2 mm. in diameter and these consist mainly of calcium carbonate. The coarse sand fraction consists of silica, except in the Gezira soil, in which it consists of 80 % of calcium carbonate. The fine sand fraction is mainly silica with

A mechanical analysis of the above soils gave the following results

Type	Flood alluvium	Badob	Khor soil	Goz soil	Blue clay soil
Locality	Kassala	Gezira Blue Nile	Um Ruaba Kordofan	Abu Haraz Kordofan	Nasser Upper Nile
Colour	light brown	dark brown	black	red	slate blue
Stones and gravel %	0.0	2.7	0.0	1.1	0.0
Coarse sand %	5.4	16.0	1.7	31.9	5.2
Fine sand %	15.7	10.2	15.2	34.8	13.4
Silt %	37.2	10.8	15.1	2.8	13.8
Clay %	40.7	5[illegible]	68.1	29.5	67.6
Soluble salts %	0.028	0.100	0.035	0.005	0.020
*p*H	8.3	9.4	8.1	8.5	8.5

about 15 % basic oxides except in the case of the Abu Haraz red soil where it is 98 % silica.

The clay fractions from Gezira, Um Ruaba and Nasser blue clay contain about 48 % silica and 38 % basic oxides. The clay from Kordofan red soil has 42 % silica and 45 % basic oxides.

It appears that a very important factor in determining the plasticity of a clay is its composition as shown by the molecular ratio of silica to alumina.

W. S. G.

Ukrainian Soil Investigations.

I. Prof. G. MAKROFF (Origin and evolution of Ukrainian soils). *Vistnik Silsko-Gospodarskoi Naouk* (1) Vol. III, Nos. 3 and 4, pp. 6-22, map. Kharkov, 1924.

II. Prof. V. KROKOS (Loess and fossil soils of South West Ukraine). *Ibid.* pp. 22-31.

I. — The author refers to the work of Prof. DOKUCHAIEFF, whose researches on Russian soils and particularly on the origin of tchernozem, have become classic: he was the first to establish the method of natural zone classification, based on the conformation of the ground, and to seek the explanation of the origin of the soils in the influence of climatological, orographical and biological conditions. Prof. DOKUCHAEFF's method has been largely followed in Russia and a series of valuable researches have since been made. Unfortunately these investigations have always been limited to a restricted area, and an extended survey over a region large enough to lead to wide general views, has not been possible until recently.

The author has succeeded in supplying this deficiency, thanks to the mission which was entrusted to him in 1921 by the Ukrainian Scientific

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(1) *Journal of Agricultural Science* published by the Scientific Agricultural Committee of Ukraine.

Agricultural Committee, and has been able to make a detailed examination of Ukrainian soils and to draw up a pedological chart. This investigation is not yet completed, but the author believes he has already obtained certain results which are not without interest and which are given in this article.

In the description of the Ukrainian soils, the author states that the country is divided into two climateric regions by the line of a barometric maximum which crosses the country from east to west, following a curve touching the towns of Kharkov, Poltava, Krementchoug, Kamenetz and Podolsk. To the north of this line the atmospheric precipitations are greater, and have an annual average of 500-600 mm. The summer is less warm and dry, the temperature more constant, with narrower deviations between maximum and minimum and the prevailing winds blow from the west ; the climate of this region is termed a *cyclonic climate*. To the south of the barometric line the climate is dryer, with wider deviations between minimum and maximum temperature, and the prevailing winds come from the east This is a *monsoon climate*.

From the orographical point of view, the author mentions the high land in the Provinces of Volhynia and Podolia which slope northward to the Pripet, eastward to the Dnieper and southward to the shore of the Black Sea. A second chain of high land forms the left bank of the Dnieper, a third, the Donetz chain (Kriaj), which joins the Berdiansk-Mariupol plain The principal lowlands are those of the Pripet and Dnieper valleys, as well as the steppe, which forms the shore of the Black Sea, of which the lowest part is the North Tauride steppe

The high lands are characterised by a moister and colder climate whereas the valleys have a warmer and much dryer climate.

The principal bed-rock on which the soil through the country has formed, is a loess of eolian origin, the upper layers of which afterwards become transformed into tchernozem, owing to the accumulation of plant residues which have supplied the humus.

The author distinguished three different kinds of loess : (1) sub-sand and sub-clayey loess of the northern region, which contains 82 % of SiO_2, 10 % of Al_2O_3 and 4 % of oxide of iron This loess is very porous and of a very pale straw yellow. (2) The loess of the middle region is subclayey and contains 70 % of SiO_2 and 14 % of Al_2O_3. (3) The loess of the southern region is decidedly clayey and of a dark straw yellow, and contains 65 % of SiO_2 and more than 15 % of Al_2O_3.

In the regions of the north-west, towards the valley of the Pripet, at present covered with forests (called the Poliessia region), the upper layers of loess have become metamorphosed into podzol, marshy podzol and peat. In the whole of the remaining territory of Ukraine the upper soil layers are formed of tchernozem

The northern zone, above the line of the barometric maximum, was at a certain epoch covered with forests, especially in the hilly region, whereas the steppes of the south supported only herbaceous vegetation. This is the cause of the difference observed in the qualities of tchernozem and in the thickness of the beds in these two regions. The author describes five tchernozem zones, characterised by different qualities and thicknesses of soil:

(1) The northern zone, of which the tchernozem contains 4-5 % humus, the soil being slightly clayey and the carbonates it contains being in the form of lublinite.

(2) The zone rich in tchernozem, of forest origin, and which extends southward as far as the line of the barometric maximum, the southern limit of the ancient forests. The tchernozem layer here has a depth of 150 cm., and contains from 5-6.5 % of humus; the soil is sub-clayey and the carbonates are also in the form of lublinite.

(3) The zone of the ordinary tchernozem, immediately to the south of the barometric line is characterised by a dryer climate. The soil is clayey and sub-clayey and contains 6.5-7.5 % of humus, but the depth is not more than 100 cm.; the carbonates are of two forms, lublinite and "biloglazka", the former being characteristic of a moister, and the latter of a drier climate. This zone extends in the direction of the Sea of Azov. But the area extending from the littoral for a distance of 100 kilometres from the coast, to the Donetze chain, shows a certain difference in the soil formation; the tchernozem is only 90 cm. in thickness and contains only 5 to 6 % of humus, and the carbonates, though present in both forms, contain more "biloglazka"

(4) The southern zone towards the west, the steppes of the Black Sea, is characterised by a soil 70-80 cm. in thickness containing 5-6.5 % of humus, with carbonates in the form of "biloglazka".

(5) The zone of the shore of the Black Sea, lower and dryer than the preceding one, has a layer of tchernozem from 40 to 50 cm. in thickness, which becomes more and more saline as it approaches the coast.

When discussing the question of origin, the author gives the different points of view respecting the causes of forest growth in the northern zone, whereas the steppes, to the south of the barometric line, had only herbaceous, though very abundant vegetation Apart from the influence of a moister climate, certain scientists have tried to explain this fact by assuming the existence of an older plant evolution, the northern zone having emerged from the sea long before the southern steppes; others explain the fact by the excessive salinity of the southern soils, of which the saline solutions are more concentrated in consequence of the dryness of the climate. The author does not exclude the influence of these factors but considers the true explanation to be a combination of climateric, orographical and biological causes; in his opinion, *the northern zone has always been a region of more intense plant and animal life, owing to the conditions of conformity, climate and sub-soil there ruling.* This view is supported by the innumerable mole-hills with which the soil of this zone is covered, though the rodents which made them were afterwards driven southwards by the forest-growth. The latter has caused great humification of the upper layer of the soil, which in turn has given rise to the formation of soluble organic substances in the sub-soil, under the influence of which the breaking down of the silicious parts of the soil has taken place.

With regard to the degree of salinity of the soils of the southern zone and the plain regions, the author considers that the horizon of conglomeration of the soil at certain depth, may serve as a characteristic index for the degree of salinity. The conglomeration horizon is found at a depth of 10-30 cm. in the low plains, 40-60 cm. in the ancient forest zone, 40-50 cm. in the (ordinary) tchernozem and 80-90 cm. in.the southern steppes.

In conclusion, the author again refers to the subject of Ukrainian loess and notes certain of its typical charactiristics. This soil is always intersected, at a certain depth, by sedimentary, beds, which divided the loess into several layers. The author considers that these layers are generally four in number; their number increases towards the south and diminishes towards the north, on approaching the ancient regions of glaciation. The beds which separate the superposed loess sections are generally of fossil soil; in the north, in the region of the ancient glacier of the Valley of the Dnieper, the layers of fossil soil are placed above the moraine. To the south of the glaciation region the fossil soils belong to the type of forest clays. In the southern steppe, the fossil soil has no trace of alluvial horizon.

II. — The article by Prof. V. **Krokos** completes the above investigation by giving the result of the investigations made at a depth to investigate the stratification of the loess and the process of its formation. By means of borings to a depth of 18 metres, which however did not reach the tertiary rocks, the author observed that the loess layer is composed of at least four stages of which the deepest are separated by layers of fossil soil, while the last but one is separated from the last, by a layer of fossil soil and a deposit of moraine. The author explains the formation of these layers by the alternate advance and retreat of the Dnieper glacier The four layers of loess would therefore correspond to four successive periods of glaciation In receding, the glacier formed torrents of melted snow which carried away numerous small rock debris, the moraines formed by these torrents afterwards disintegrated, and the wind, carrying away their dust, left deposits which by accumulation gave rise to the layers of loess Indeed, the chemical analysis of the loess and the moraine below the first layer of loess, proved them to be of very similar chemical composition. The author explains the absence of moraines between the lower sections of loess by their complete disintegration and subsequent removal by wind. The moraine between the first (upper) and the second layer of loess remained intact, because at that period the great Dnieper glacier receded further, dividing into several small glaciers, and the light local winds which prevailed at that period could not entirely disintegrate the masses of rocks brought down by their torrents. The analysis of the loess revealed another interesting particular: the SiO_2 content decreases in all the layers of loess in proportion to their distance from the valley of the Dnieper; this indicates that, during the accumulation of the loess a coarser substance than the dust of the moraines intervened, transported by the winds coming from that valley.

An examination of the layers of fossil soil which separate the layers of loess reveals the fact that all three layers are composed of ancient black soils, analogous to the present tchernozem, but which have lost most of their humus. The upper layer still remains a dark coloration, and is found at a depth of 3.2 metres; the second layer, situated at a depth of 9.4 metres, is much lighter in colour, and the third layer, at a depth of 9.1 to 16.3 metres is light yellow and rich in carbonates. The humus content of these layers is very slight, varying from 0.5 to 0.7 % which decreases with their depth. The carboniferous layers contain much more CO_2 than humus.

The first layer is a little less than 100 cm. in thickness, whereas the other two are more than 100 cm. in thickness. These thick layers of ancient tchernozem show that formerly the steppe had a more humid climate than at present, and that it was always covered with luxuriant vegetation. G Z.

Geological Observations on the ancient Soils of Mt. Pisano.

MASINI, R , *Bollettino della Società geologica italiana*, Vol XLII, Part 1, pp. 68-108, figs 4, 1 map Rome, 1924.

Mount Pisano is of an elliptical shape divided into two parts by the Valley of S. Maria del Giudice ; the eastern part is formed of ancient soils, the western of more recent soils , they are connected by the hill of S Giuliano, whence runs the Lucca-Pisa pass.

The rocks of the ancient soils of Mt. Pisano may be divided into conglomerates and pudding-stones (some varieties with pebbles), gravel-stones more or less quartzitic, often laminated and schistose, and schists properly so-called. A general characteristic of all these soils is the almost total absence of lime.

The decomposition of the schists and occasionally of the semiocl ieous gravel-stones gives rise to the red and white soils.

In some places (Fosso del Mulino, Rio Borello, Rio delle Macine) there is a graphitic anthracite, very fragile and heavy and difficult to burn.

The layer of the soil of Mt. Pisano is uniform, and is probably an instance of a long, continuous series, formed at the expense of an ancient excrescence of granite rocks, or something similar to granite. As regards age, it does not seem to be much below the carboniferous, nor is there so far. any reason for concluding that the deepest part is Silurian or Cambrian.

The conglomerates, pudding-stones and those varieties of gravelstone which are most adapted to stone-cutting, are known as " verrucano " (oil-mill stone) in the Province of Pisa, and as " pietra bigia " (grey-brown stone) in the Provincie of Lucca. Other local names are " pietra salina " for the more granular gravelstone and " lucciche " for the conglomerate. A. F.

The Soils to the East of the Catria Range.

PRINCIPI, P Studio del terreno ad est della catena del Catria. *Bollettino della Società geologica italiana*, Vol XLII, Part I. pp 36-46, 1 table Rome, 1924

Pink limestone and pink schists give rise to the heights known as Monti Bambino, Campifobio, Mezzano, Morcia, Spicchio, Comunelle, Vincione, Croce della Serra, Calvello Venatura, Valdolmo di Stavellina, di Frontone, and Poggio Pantano. They also form those which extend from Castello di Sassoferrato, Mt. S. Croce, Mt. Orso and Mt. di Nebbiano to the North of Fabriano ; these heights form an anticline to which the mesozoic excrescences of Mt. Rotondo, Poggio Roeta, Mt. Romano and those of Mt. Donico and Mt. Borea near Acqualagna also belong. Following this anticline there is another, which after having formed the secondary undulations of Mt. Paganuccio and Mt. Pietralata, continues to the East of Pergola, whence the above formations continue in a south-easterly direction, forming Mt. Pelato and the Arcevia heights.

The pink limestone and pink schists of the first group above-mentioned are followed by a series of strata formed by greenish-grey or red alternating scaly schists with intercalations of brown clay limestone, rich in nodules of pirites and patches of hydroxide of iron. This combination forms the so-called *ash layer*, which belongs to the lower Eocene. Near the station of Sassoferrato it appears as a greenish-grey strata, of which some very marly layers are used for making a quick-drying cement Towards the Strega Mountain, the ash layer becomes more and more clayey and includes beds of " splintering " limestone, which also crop out on the other side of the syncline included between the above Mountain and the promontories of Sassoferrato

Following the ash layer there is another formation of alternating grey schist limestone marls, which contain beds of compact whitish or ash-coloured marly limestone. The marls are known locally by the name of " genga " and the limestone by that of " bisciaro ".

The principal fossiliferous localities known to exist in the district under examination, are those of Colbacchione and Farneta to the West of Acqualagna, Pergola and Serra S. Abbondio. The combination of groups here met with is classed with the Langhiano and has a band of rather deep marine marls

The beds of more or less marly limestone sometimes predominate over the schist marls, assuming the same aspect of flinty limestones intercalated in the ash layer. Both are locally known by the name of " bisciaro ", which is applied however to two levels, *i. e.*, to the Eocene (ash layer) and the Langhiano (scaly marls overlying the former). The " bisciaro " of the Urbinate has a band somewhat characteristic of the Langhiano marly limestone formation. Between the Eocene ash layer and the Langhiano compact scaly marls there may be a gap, though it is concealed by an apparent parallelism of the strata.

Following the Langhiano marly limestone zone there is a series of large beds of blue-grey gravelstone, sometimes lenticular in form (S Savino, Mt. Vecchi, Mt. Torrino, Mt Aiate) Towards Mt Torrino the gravelstone, which contains 40 % of carbonate of lime, changes at various points into actual pudding-stone. Not far from Mt Vecchietto there are volcanic rock or crystal-schist pebbles, which probably originated from the remains of tertiary layers in a state of disaggregation and sediments which were stratifying on the bottom of the sea Fossils are very scarce throughout the formation.

From Mt. Aiate, towards the Cinisco torrent there are schisty gravel marls with tripolaceous layers and lenticular chalk, which must belong to the highest part of the Myocene, *i. e.* the Messinian. Near Canneto there is a considerable development of chalky bituminous marls, distinctly stratified, of a dark grey colour, called " ghioli ", in which there are some traces of sulphur. Sulphur is abundant at Cabenardi and Percozzone, where there are important sulphur mines. The sulphur series of strata is almost vertical, and the lime of which it is formed is dark grey or yellowish, marly, and of vacuolar structure, and is interspersed between the " ghioli ", chalky at the top and a bituminous limestone at the sides. In some point the more or less modified sulphur limestone (" magnone ") crops out

The bottom of the valleys of the Cesano and Cinisco torrents is formed of quarternary gravels with discoidal elements, which may attain a thickness of 60 metres, other alluvial deposits are found at various altitudes along the slopes of the heights bordering the two water-courses. Such gravels originate from rocks which form the framework of the Catria.

The leading contours of the region examined are three anticlines running north-west and south-east (1) the Strega Mountain and Mt Mura, (2) Mounts Nebbiano, Sassoferrato, Madonna del Sasso and Acqualagna, (3) Mounts Arcevia, Mezzanotte, Barbanti and Furlo Between the two synclines thus formed are the two Messinian zones of Canneto and Percozzone-Cabenardi A F

Literature.

General

Hissink, D. J. Rapport betreffende de scheikundige en de mechanische samenstelling van ennige grondmonsters, afkomstig uit den polder zuidveen, uitgebracht op verzoek van de commissie voor de partieele bemaling van het waterschap Vollenhove Verslagen van Landbouwkundige Onderzoekingen der Rijkslandbouwproefstation, No XXIX, 1924.

Pankoff, A. Naturwissenschaftlich Geschichtliche Gebiete des Gouvernements Woronesh

Soule Andrew M. Stop the Losses in Farming *Georgia State College of Agriculture*, Vol. VIII No 33, Bul. 211.

Soil Physics.

Blanck, E and Alten, F. Ein Beitrag zur Frage nach der Vorbehandlung der Böden mit Ammoniak fur die Atterbergsche Schlammanalyse. *Journal fur Landwirtschaft*, pp. 153-162, 1924.

Fischer K Der Sinn der Gleichung . Niederschlag Abfluss-Verdunstung · Versickerung *Meteorolog. Zeitschrift*. Part 8, 1924

Fischer, K. Die Verdunstung des Weserquellgebietes in methodischer Hinsicht betrachtet. *Meteorolog. Zeitschrift*, Part 7, 1924.

Pankoff, A Einige Angaben uber die physikalischen Eigenschaften des Bodens nach Atterberg. Wladikawkas, 1922.

Soil Chemistry.

ARRHENIUS, O. Markreaktion och Skördeutbyte, O. L. Svanbäcks Boktryckeri. Stockholm, 1923.

BARNETTE, R. M., GERRETSEN, F. C., HISSINK, D. J., and VAN DER SPEK, J. De calorimetrische bepalling van den zuurgrad van den grond. *Chemisch weekblad*, deel 21, No. 12, 1924.

BARNETTE, R. M, HISSINK, D. J., VAN DER SPEK, Jac. Some remarks on the determination of the hydrogen-ion concentration of the soil. *Recueil des travaux chimiques des Pays-Bas, publ. par la Soc. chim. néerl* (Haarlem, Hollande, 33. Eindenhoutstraat (4) 5, No. 5, (15 May 1924).

BLANCK, E and ALTEN, F. Experimentelle Beiträge zur Entstehung der Mediterran-Roterde. *Die landwirtschaftlichen Versuchstationen* 90, 1924.

BLANCK, E and ALTEN, F Beitrage zur Kennzeichnung und Unterscheidung der Roterden *Die landwirtschaftlichen Versuchstationen*, pp. 41-72, 1924

CARTER, L M, LOWRY, M W., COLLINS, W O., SOULE, A. M. Analyses of Soils of Floyd County. *Georgia State College of Agriculture*, Vol. X, No 15. Bulletin 277, 1923.

CARTER, L M, LOWRY, M. W., COLLINS, W. O., SOULE, A. M. GLENN, L FULLER Analyses of Soils of Burke County. *Bulletin Georgia State College of Agriculture*, Vol XIII, No. 5, Bulletin 302, 1924

FAIN, INO R Rock Phosphate, Georgia State College of Agriculture *Circ* 20, 1916

GALLAY, RENÉ Contribution à l'étude de la coagulation de l'argile. Thèse présentee à l'école polytechnique fédérale pour l'obtention du grade de docteur des sciences techniques 1924

HISSINK, D. J. Studie van en Proefnemingen op Slempige Gronden door het Rijkslandbouwproefstation Groningen (Afdeeling voor Grondonderzoek) Voorloopig verslag, uitgebracht op verzoek van de betrokken Vereenigingen, 1924

HISSINK, D. J. De Natuurkundige en scheikundige veranderingen, die kweldergronden na de indijking ondergaan *Verslagen van Landbouwkundige Onderzoekingen der Rijkslandbouwproefstations* No. XXIX, 1924.

HISSINK, D. J. Base Exchange in Soils. *Reprinted from the Transactions of the Faraday Society*, No. 60, Vol. XX. Part 3, 1925.

HISSINK, D. J. Der Sättigungszustand des Bodens. Sonderdruck aus der *Zeitschrift f. Pflanzenernährung und Düngung*. Verlag Chemie, Leipzig, Bosestrasse 2. Year 4, Part 3.

LINCK, G., BLANCK, E. Chemie der Erde. *Zeitschrift der chemischen Geologie, chemischen Mineralogie und Bodenkunde*. Verlag Gustav Fischer, Jena.

LUENING, O. und BEBENROTH, H. Das Verhältnis von Mg zu Ca in Harn und Jauche, sowie in Abwässern und Grundwässern. *Zeitschrift fur angew. Chemie* 38 112, 1925.

LYON, T H, BIZZEL, J A and WILSON, B D Depressive influence of certain higher plants on the accumulation of nitrate in soil *Journal of the American Society of Agronomy*, Vol 15 No 11, Nov 1923

LYON, T L and BUCKMAN, H C Availability of the phosphorus of floats as influenced by incorporation of farm manure in the soil *Journal of the American Society of Agronomy*, Vol 16, No 2, February 1924

NEMEC, A and KVAPIL, K Sur la composition des sols forestiers Chimie agricole, *Comptes Rendus des seances de l Académie des Sciences* Vol 179, p 537, Meeting of the 15 Sept 1924

NIKLAS, H and HOCK, A Bestimmung der Reaktion und der Kalkbedurftigkeit von Boden der Pfalz (Blatt Speyer) *Geogn Jahresh* Year 36, 1923, pp 169-174

VILENSKY, D (Kharkow, Ukraine) On the amelioration of alkaline soils and on the struggle against reiterated alkalizing by irrigation (Russian)

WILENSKY, D C (Tiflis) Das Entstehen der Alkali-Boden (Russian)

WORSHAM, W A Jr, LONG, DAVID, D, CARTER, L M LOWRY M W, COLLINS, W O Analyses of Soils of Jasper County *Georgia State College of Agriculture*, Vol VII, No 6, Bulletin 160, 1918

WORSHAM W A Jr, LONG, DAVID D, CARTER L M, LOWRY, M W, COLLINS, M W Analyses of Soils of Wilkes County *Georgia State College of Agriculture* Vol IX, No 10 Bull 225, 1920

WORSHAM, W A, LONG DAVID D, CARTER, L M LOWRY, M W COLLINS, W O Analyses of Soils of Crisp County *Georgia State College of Agriculture* Vol VIII No 3 Bull 181

WORSHAM, W A Jr, LONG, D D, CARTER, L M, LOWRY, M W Analyses of Soils of Dougherty County *Bull of Georgia State College of Agriculture*, Vol V No 17, Bull 126, 1917

WORSHAM, W A Jr, LONG, D D, CARTER, L M, LOWRY, M W, COLLINS, W O Analyses of Soils of Polk County *Bull Georgia State College of Agriculture*, Vol V, No 18 Bull 127 1917

WORSHAM, W A, CARTER, L M, LOWRY M W, COLLINS, W O Analyse of Soils of Pierce County *Georgia State College of Agriculture*, Vol IX No 9, Bull 248, 1921

WORSHAM, W A CARTER, L M, LONG DAVID, D LOWRY, M W Analyses of Soil Types of Troup County *Georgia State College of Agriculture*, Vol IV, No 2, Bull 92

WORSHAM, W A Purchasing Ground Phosphate Rock *Georgia State College of Agriculture*, Circ 42, 1917

Soil Biology

BRENNER, WIDAR Azotobakter in Finnlandischen Boden Geol Kommissionen i Finnland No 20 Agrogeolog Meddelanden, Helsingfors

PANKOFF, A Die Tiere des Bodens und ihre Bedeutung fur die Bodenbildung Sonderabdruck aus den *Versuchsberichten' des Gebiete Woronesch* Tschernosiom, Nos 5 6, 1921

Soil and Vegetation.

BLANCK, E. and ALTEN, F. Ein Vegetationsversuch mit "Asahi Bromoloid". *Journal für Landwirtschaft*, pp. 139-143, 1924.

BLANCK, E. and ALTEN, F. Zur Wirkung des Zeotokols (Doleritmehl) auf die Pflanzenproduktion. *Journal. fur Landwirtschaft*, pp. 145-152, 1924.

ENGELS. Die Bedeutung geologisch agronomischer Bodenuntersuchungen fur die Landwirtschaft. *Die Ernährung der Pflanze*, No. 22 1924. Herausgegeben vom Deutsche Kalisyndikat G m. b. H.

KINGER, J. B. Climate of the Great Plains as a Factor in their utilization. *Annals of the American Geographers*, XIII, No. 2, June 1923.

SHANTZ, H L, and MARBUT, C F The vegetation and soils of Africa. With a section on the land classification of Agrica by the joint authors, and a note on a rainfall map of Africa by KINGER, J. B. Published jointly by the National Research Council and the American Geographical Society, Broadway at 150th street, New York, 1923.

SHANTZ H L The Natural Vegetation of the Great Plains *Annals of the Americ Geographers*, XIII, No 2, June 1923

SUECHTING, H Zur Kennzeichnung einiger abnormer forstlich genutzter Boden Festschrift der forstlichen Hochschule Hann Munich, 1924.

WIEDEMANN, EILHARD Zuwachsruckgang und Wuchsstockungen der Fichte in den mittleren und unteren Höhenlagen der sachsischen Staatsforsten 180 pages Kommissionsverlag W Laux Tharandt, 1923

Soil Nomenclature, Classification and Mapping.

AARNIO, B (Helsingfors) u STRECHTE, H (Danzig) Zur Frage der Bodenbildung und Bodenklassifikation. Mémoires sur la nomenclature et la classification des sols Intern Soc. of Soil Sc. IV Com. Helsingfors 1924.

ANDERSEN, JOHANNES, Copenhagen Nomenclature et classification du sol de Danemark. Mémoires sur la nomenclature et la classification des sols. Intern. Soc. of Soil Sc , IV Com. Helsingfors, 1924.

BJOERLYKKE, K. O. Aas, Norwegen, Die Nomenklatur und Klassifikation der Bodentypen in Norwegen Intern. Soc. of Soil Sc IV Com. No. 13.

BJOERLYKKE, K. O. Aas. Die Nomenklatur und Klassifikation der Bodentypen in Norwegen. Mémoires sur la nomenclature et la classification des sols Intern. Soc. of Soil Sc. IV Com Helsingfors, 1924.

BRENNER, W. (Helsingfors). Über die Reaktion finnländischer Böden. Mémoires sur la nomenclature et la classification des sols. Intern. Soc. of. Soil Sc., IV Com. Helsingfors, 1924.

CHRISTENSEN, HARALD R. Lyngby. Landwirtschaftliche Klassifizierung und Beschreibung der dänischen Böden. Mémoires sur la nomenclature et la classification des sols. Intern. Soc. of Soil Sc. IV Com. Helsingfors, 1924

Encoulesco, P. Bukarest. Le climat comme facteur de variation des types zonaux de sol. Mémoires sur la nomenclature et la classification des sols. Intern. Soc., of Soil Sc., IV Com. Helsingfors, 1924.

Frosterus, Benj. Helsingfors. Die Klassifikation der Böden und Bodenarten Finnlands. Mémoires sur la nomenclature et la classification des sols. Intern. Soc. of Soil Sc., IV Com. Helsingfors, 1924.

Frosterus, Benj. Die Klassifikation der Böden und Bodenarten Finnlands. Geol. Kommissionen I. Finnland No. 18. Agrogeolog. Meddelanden. Helsingfors.

Glinka, C. D. Petrograd. Différents types d'après lesquels se forment les sols et la classification de ces derniers. Mémoires sur la nomenclature et la classification des sols. Intern. Soc. of Soil Sc. IV Com. Helsingfors, 1924.

Hallisy, T. Dublin. Soil Research and the question of Nomenclature and Classification of Soils in Ireland. Mémoires sur la nomenclature et la classification des sols. Intern. Soc. of Soil Sc., IV Com. Helsingfors, 1924.

Hissink, D. J. Groningen. Versuch einer Nomenklatur und Klassifikation der Niederländischen Böden, nebst Bemerkungen der Methodik. Mémoires sur la nomenclature et la classification des sols. Intern. Soc. of Soil Sc., IV Com. Helsingfors, 1924.

Hume, W. E. Cairo. Character of the Soil of Egypt. Mémoires sur la nomenclature et la classifilation des sols. Intern. Soc. of Soil Sc. IV Com. Helsingfors, 1924.

Johansson, Simon, Stockholm. Classification and terminology of Swedish soils, especially mineral soils, used by the Geological Survey of Sweden. Mémoires sur la nomenclature et la classification des sols. Intern. Soc. of Soil Sc., IV Com. Helsingf., 1924.

Larue, Pierre, Gurgy. Sur la Classification des terres en France Mémoires sur la nomenclature et la classification des sols. Intern. Soc. of Soils Sc., IV Com. Helsingfors, 1924.

Miklaszewski, Stawomir, Warsaw. Les sols comme individus. Mémoires sur la nomenclature et la classification des sols. Intern. Soc. of Soil Sc., IV Com. Helsingfors, 1924.

Murgoci, G. Bukarest. Considerations concerning the Classification and Nomenclature of Soils. Mémoires sur la nomenclature et la classification des sols. Intern. Soc. of Soil Sc., IV Com. Helsingf., 1924.

— Nomenclature et classification des sols. (Mémoire rélatif à la Pologne). Mémoires sur la nomenclature et la classification des sols. Intern. Soc. of Soil Sc., IV Com. Helsingfors, 1924.

Novák, N. Brünn. Die bei der Bodenforschung in der Cechoslowakei benutzte Nomenklatur und Klassifikation. Mémoires sur la nomenclature et la classification des sols. Intern. Soc. of Soil Sc., IV Com. Helsingfors, 1924.

V. Post, L. Stockholm, Das genetysche System der organogenen Bildungen Schwedens. Mémoires sur la nomenclature et la classification des sols. Intern. Soc. of Soil Sc., IV Com. Helsingfors, 1924.

Robinson, G. W. Bangor, Wales. Soil Types of North Wales. Mémoires sur la nomenclature et la classification des sols. Intern. Soc. of Soil Sc., IV Com. Helsingfors, 1924.

Stremme, H. Die Verbreitung der Bodentypen in Deutschland. Mémoires sur la nomenclature et la classification des sols. Intern. Soc. of Soil Sc., IV Com. Helsingfors, 1924.

Tesch, P. Haarlem. Versuch einer Nomenklatur und Klassifikation der Niederländischen Bodenarten (Sous-sols) nach rein petrographischen Gesichtspunkte und mit Benutzung der in den Niederlanden ublichen Bezeichnungen. Mémoires sur la nomenclature et la classification des sols. Intern. Soc. of Soil Sc., IV Com. Helsingfors, 1924.

Till, A. Wien. Zur Frage der Bodenkartierung und Klassifikation. Mémoires sur la nomenclature et la classification des sols. Intern. Soc. of Soil Sc., IV Com. Helsingfors, 1924.

Treitz, P. Budapest. Die Bodenregionen im geschichtlichen Ungarn und die Stellung der Hauptbodentypen zu der allgemeinen Bodenklassifikation. Mémoires sur la nomenclature et la classification des sols. Intern. Soc. of Soil Sc., IV Com. Helsingfors, 1924.

Wolff, W. Bemerkungen uber die Klassifikation und Nomenklatur der Böden bei den Arbeiten der Preuss. Geol Landesanstalt. Mémoires sur la nomenclature et la classification des sols. Intern. Soc. of Soil Sc., IV Com. Helsingfors, 1924.

Regional Soil Science.

Bjoerlykke, K. O. Typical Soil Profiles in Norway Com. IV. No 25, 1924

Davis, L. V. Use of Agricultural Lime in Georgia. *Georgia State College of Agriculture, Vol. XI Bull 271.* No 11.

Jochems, S. C. J. *Mededeelingen van het Deli proefstation de Medan-Sumatra* Tweede Serie No XXIII. Verslag van de Selectioproeven over het jaar 1921.

Marbut, C. F. Soils of the Great Plains. *Annals of the Association of American Geographers*, XIII, No. 2, June 1923.

Maschhaupt, J. G. and Hissink, B. J. Onderzoek naar de gesteldheid van den bodem in den zuid-hollandschen beesebosch. *Verslagen van Landbouwkundige Onderzoekingen der Rijkslandbouwproefstation,* No. XXIX, 1924.

Pankoff, A. Ueber den Boden in Nord-Kaukasus. Aus den Bodenuntersuchungen von Kabard, 1924.

Reis, O. M. Ueber Böden aus dem Unterrotliegenden im Lautertal zwischen Olsbrücken und Wolfstein. *Geogr. Jahresh.*, 1923 Year 36, pp. 176-176. Munich, 1923.

General Notices.

Rules of the International Society of Soil Science.

I. — NAME, OBJECTS AND HEADQUARTERS OF THE SOCIETY.

1. The Society shall be called the " International Society of Soil Science ".
(French : " Association Internationale de la Science du Sol ").
(German : " Internationale Bodenkundliche Gesellschaft ").
(Italian : " Società Internazionale della Scienza del suolo ").
(Spanish : " Sociedad internacional de la ciencia del suelo ").

2. The object of the Society is the study and promotion of soil science in general by means of :

(*a*) the organisation of Congresses and Conferences ;
(*b*) the formation of Sections and Committees ,
(*c*) the publication of a Review ;
(*d*) the institution of a Central Office for Soil Science bibliography (documentation) at the International Institute of Agriculture at Rome.

3. The headquarters of the Society is the International Institute of Agriculture at Rome.

II. — MEMBERSHIP.

The International Society was founded by the Fourth International Conference and persons who took part in this Conference have the right to join the Society as foundation members.

Any individual or body corporate engaged in the study of soil science is eligible for ordinary membership of the Society. The names of new members must be proposed by two members and will be published in the review.

5. The Congress may appoint honorary members on a proposal made by the Executive Committee.

6. For particular countries sections may be formed within the Society either for the study of soil science in general or for the study of certain aspects of the subject

Every section consisting of more than 15 members has the right to be represented on the General Committee by one member.

III. — CONSTITUTION OF THE SOCIETY.

7. The Society carries out its work through the following bodies :

(*a*) the Executive Committee (Bureau),
(*b*) the General Committee,
(*c*) the Sub-Committees.

8. The Executive Committee is responsible for the general business of the Society. Its membership is as follows :

(i) the President,
(ii) the Vice-President,
(iii) two ordinary members,

(iv) a representative of the International Institute of Agriculture at Rome,

(v) the General Secretary,

(vi) the Editor of the Review,

(vii) the Librarian.

The President, Vice-President, General Secretary and Librarian are appointed on the first occasion by acclamation, afterwards by a majority ballot vote of the members of the Association A new election of the President, Vice-President, the ordinary members, the General Secretary and the Librarian takes place at each Congress. All are eligible for re-election with the exception of the President, who by the rules of the Society must always be a member of the Society belonging to the country in which the next Congress will be held.

The representative of the International Institute of Agriculture at Rome is appointed by that Institute

The duties of the General Secretary may be discharged by one of the other members of the Executive Committee. The necessary staff and funds will be found by the same body

The editor of the Review is elected by the General Committee: he continues in office and can only be removed by a two-thirds majority of the General Committee.

9. The General Committee is composed of the Executive Committee and a certain number of members elected by the Congress by show of hands, and also representatives of the Sections (§ 6) and of the Sub-Committees (§ 10).

Each State has the right to be represented on the General Committee by at least one member

The General Committee drafts the agenda for the Congress and for the Sub-Committees It meets as required, and at least once in the interval between the meetings of the Congress

The President of the Executive Committee is chairman of the General Committee.

10. The Sub-Committees are appointed by the Congress or by the General Committee for the study of particular aspects of soil science. They determine their own constitution and have the right to add to their numbers directly. They are represented on the General Committee by one member.

IV. — THE CONGRESS.

11. The Congress is under the general patronage of the International Institute of Agriculture in Rome.

12. A Congress must be summoned at least every five years by the Executive Committee by arrangement with the International Institute of Agriculture in Rome. All members of the Association shall be invited as well as persons specially qualified in Soil Science who are not already members.

The Executive Committee will fix the place and date of the Congress after consultation with the International Institute of Agriculture in Rome. In this connection it is necessary as far as possible to consider the wishes expressed by the preceding Congress.

13. The scientific work of the Congress consists in the presentation of

reports, discussions, demonstrations and where desirable in the arrangement of exhibitions. In addition the Congress has the following administrative duties:

(*a*) The consideration of the Report of the Vice-President on the work of the Association since the preceding Congress;

(*b*) The consideration of the Report of the General Secretary on the financial situation and also the report of the auditors and final approval of the accounts; election of auditors for the next financial period,

(*c*) Election of the President, Vice-president, two ordinary members, the General Secretary, the Librarian, the three auditors as well the remaining members of the General Committee, in so far as the Congress has power to make such appointments.

V. — THE REVIEW.

14. The Review is published by the Executive Committee under the direction of the editor. The printing and publication is undertaken by the International Institute of Agriculture in Rome.

It will appear in separate numbers, forming an annual volume, beginning with January 1, 1925. It is a purely scientific review for original work on general soil science.

It also serves the following purposes:

(*a*) The establishment of as full a conspectus as possible of the most recent publications concerning soil science as a whole and kindred subjects.

(*b*) Abstracts of the most important recent publications.

(*c*) Publication of information relating to the activities of the Society in English, French, German, Italian and Spanish.

15. The Executive Committee will supply the editor with the staff and means to carry out his work. The Sections and Sub-Committees appoint their own assistants, whose business it is to collect the documentation and to publish information relating to the Society so far as it relates to the special work of the Section or Sub-Committee.

16. The members of the Society are entitled to receive the Review gratuitously after payment of their annual subscription.

VI. — FINANCE OF THE SOCIETY.

17. The funds of the Society are provided as follows:

(*a*) by the annual subscription of members, the amount to be fixed each year by the Executive Committee,

(*b*) by the amount of the subscriptions to the Review and advertisement charges, as well as by the sale of reprints and special publications;

(*c*) by voluntary contributions.

18. The Executive Committee decides as to the application of the funds and the General Secretary is responsible for finance.

19. The annual accounts must be closed at the end of the calendar year, and forwarded to the auditors and returned by them to the Executive Committee within a month at latest. The accounts are wound up each year by the Executive Committee on the certificate of the auditors.

VII. — OTHER REGULATIONS

20. The Executive Committee has the right to settle all questions that are not covered by the regulations as it sees fit and also to give decisions in all doubtful cases as regards their interpretation.

21. Proposals as to alterations in the rules may be made by any member of the Association, but must be sent in writing to the Executive Committee at least three months before the Congress, and for their acceptance a two thirds majority of the votes given is required.

22. The Society can only be dissolved after a vote taken on a report recommending dissolution and published in the Review at least a year before the vote is taken.

The Society can only be dissolved if two-thirds of all the members are agreed.

In the case of the dissolution of the Society the Executive Committee shall decide in what way the funds of the Society shall be used for the furtherance of Soil Science work.

Passed at the final meeting of the Fourth International Conference in Rome on 19 May 1924.

The Committees of the International Society of Soil Science.

I. Committee for the Study of Soil Physics and Mechanics:

Chairman: Dr. V. NOVAK, Brno, Czechoslovakia;

Vice-Chairmen: Dr. B. A KEEN, Rothamsted, Harpenden, England; Dr. C. DAVIS Washington, U. S A.; Prof U. PRATOLONGO, Milan, Italy.

Secretaries: Dr. KRAUSS, Munich, Germany; Dr. T. MIECZYNSKI, Pulawy, Poland, Ing. J. SPIRHANZL, Prague, Czechoslovakia.

II. Committee for the Study of Soil Chemistry.

Chairman: Prof. Dr. A. J. ALEXIUS DE SIGMOND, Budapest, Hungary.

Vice-Chairman: Dr. B. ARNIO, Helsingfors (Finland); Prof. Dr. M. M. MACCOOL, East Lansing, Michigan, U. S A.; Prof. Dr. A. VESTERBERG, Stockholm, Sweden, Prof. Dr. G WIEGNER, Zurich, Switzerland.

Secretaries: Prof. Dr. Robert BALLENEGGER, Budapest, Hungary; Prof. Dr. NORMAN M. COMBER, Leeds, England; Prof. Dr. Th. SAIDEL, Bucarest, Roumania; Dr. E. SCHERF, Budapest, Hungary.

III. Committee for the Study of Soil Bacteriology and Biochemistry.

Chairman: Prof. Dr. Ing. JULIUS STOKLASA, Prague, Czechoslovakia.

Vice-Chairman: Dr. HAROLD C. CHRISTENSEN, Lyngby, Denmark; Prof. Dr. H. NIKLAS, Weihenstephan., Germany; Prof. Dr. Giacomo ROSSI, Portici, Naples, Italy; Dr. S. A. WAKSMAN, New Brunswick, N. J., U. S. A.

Secretaries: Dr. D. W. CUTLER, Rothamsted, Harpenden, England; Dr. E. G. DOERELL, Prague, Czechoslovakia, Dr. NEMEC, Prague, Czechoslovakia, Prof. CONN, New York; Dr. FRED, Wisconsin U. S. A.; Dr. ITANO, Japan.

IV. Committee for the Study of Soil Fertility.

Chairman: Prof. Dr. EILH. ALFRED MITSCHERLICH, Königsberg, Prussia.

Vice-Chairmen: Dr. HARALD C. CHRISTENSEN, Lyngby, Denmark,; Dr. K. ZYLSTRA, Groningen, Holland.

Secretaries: Dr. OLOF ARRHENIUS, Stockholm, Sweden; Prof. D. R. HOAGLAND, Berkeley, California, U. S. A.; Prof. ASO, Komaba, Japan.

V. Committee for Soil Nomenclature, Classification and Soil Mapping.

Chairman: Prof. C. F. MARBUT, Washington, U. S. A.

Vice-Chairmen: Dr. BENJ. FROSTERUS, Helsingfors, Finland; Prof. G. MURGOCI, Bucarest, Rumania.

Secretaries: Prof. A. TILL, Vienna, Austria; Prof. W. WOLFF, Berlin, Germany.

VI. Committee for the Production of the Pedological Map of Europe.

Director: Prof. G. MURGOCI, Bucarest, Rumania.

Vice-Director: Prof. L. CAYEUX, Paris.

General secretary: Prof. W. WOLFF, Berlin, Germany.

VII. Committee for the Application of Soil Science to Scientific Agriculture

Chairman: Oberst J. GIRSBERGER, Kultur-Oberingenieur, Zurich, Switzerland.

Vice-Chairmen: Eng. E. GIOVANNONI, Rome, Italy; Oberbaurat OTTO FAUSER, Stuttgart, Germany; Prof. J. ZAVADIL, Brno, Czechoslovakia.

Secretary: Dr. Eng. RUD. JANOTA, Prague, Czechoslovakia.

Assessors: Prof. Dr. ZUNKER, Breslau, Germany; Prof. LZESLAV SKOTNICKY, Warsaw, Poland.

Report of the Progress of the Activities of the Organizing Committee of the Fifth International Congress of Soil Science. — At its meeting in November the American Society of Agronomy appointed Dr. C. F. MARBUT, Dr. A. G. MAC CALL and Dr. J. G. LIPMAN as members of the Organizing Committee of the Fifth International Congress of Soil Science. The Commitee, of which Dr. LIPMAN is Chairman, has been given power to appoint sub-committees and to take such other steps as may be necessary toward establishing a satisfactory organization for the Firfth International Congress.

The Committee has planned a field excursion to enable the visiting delegates to become acquainted in the field with the soil formations and crop areas of the United States. It is expected that at least a month will be allowed for this excursion, which is to take place after the adjournment of the Fifth Congress. It is probable that the sessions will be held at Washington, D. C., late in May 1927, and that the field excursion will occupy nearly all of the month of June. If possible, the special train which will be made available for the delegates will travel as far as the Pacific Coast.

Efforts will be made by the American Committee to raise a fund sufficiently large to permit of reducing the expenses of the foreign delegates to a minimum. Steps have already been taken toward the organization of local committees in Washington, D. C. These will look after the comforts o fthe visiting delegates and the members of their families. Steps have also been taken toward the arranging for exhibits of soils, soil apparatus and general scientific apparatus that might be of interest to soil investigators. Considerable progress has been made with the enrolling of members of the International Society of Soil Science. Local committees on membership are being organized.

J. G. LIPMAN.

I. Committee for the Study of Soil Mechanics and Physics. — The Committee for the Study of Soil Mechanics and Physics was formed on the occasion of the Second International Conference for Agricultural Geology at Stockholm in 1910 as a Committee for the classification of the soil particles in connection with the mechanical analysis of soil. Its first chairman was Dr. ATTERBERG, late of Kalmar, Sweden. A general meeting of the Committee was held on 31 October, 1913 at Berlin and assumed the title of " Committee for the Study of Soil Mechanics and Physics ".

At this meeting proposals were brought forward by Dr. ATTERBERG to be placed by the Committee before the next Congress for agricultural geology for approval.

The following points were dealt with :

1. Classification of the Soil Particles.
2. Subdivisions of the different groups.
3. Preparation of the soil for mechanical analysis.
4. Viscosity apparatus.
5. Collections of the finest clay products.
6. Determination of humus.
7. International comparative analysis.

The Committee were agreed on the principles of the classification of the soil particles as proposed by Dr. ATTERBERG and on the adoption of the ATTERBERG apparatus as the standard apparatus ; the lines of work in regard to the remaining points of the programme were laid down. See the decisions of the Committee in the *Internationale Mitteilungen für Bodenkunde* IV, pp. 30 and 31.

As the international conference on soil science in Petrograd in 1914 never took place, the approval of the decisions of the Committee had to be postponed. International relations were broken off on the outbreak of war and the work of the first international Committee was thereby interrupted. The work also suffered seriously from the death in 1916 of Dr. ATTERBERG who had filled the office of chairman with distinction.

It was not till the third International Congress on Soil Science in Prague 1922 that the Committee was once more re-established with M. KOPECKY of Prague as chairman. On the proposal of Dr. HISSINK the Committee carried out comparative analyses in seven European laboratories on prepared samples of soil for mechanical analysis. The report on these analyses was made to the Fourth International Congress on Soil Science in Rome in 1924 by the vice-chairman, Dr. NOVAK. At the final meeting of the First International Committee it was decided to continue the comparative analyses in regard to soil samples prepared for mechanical analysis on four more typical soil samples and to make arrangements for holding the next international soil science congress in America. The question of standard apparatus for mechanical analysis was taken out of the programme. Members of the Committee were recommended to make a study of the methods of ascertaining capacity for aeration and plasticity of the soil.

At the fourth international conference in Rome the following were elected from the Committee for the Study of Soil Mechanics and Physics:

Chairman Dr. V. NOVAK, Brunn, Czechoslovakia.

Vice-Chairmen: Dr. C. DAVIS, Washington, U. S. A.; Dr. B. A. KEEN, Rothamsted, Harpenden, England; Prof. Dr. S. ODEN, Stockholm, Sweden; Prof. U. PRATOLONGO, Milan, Italy.

Members: Prof. N. ALBERT, Eberwalde, Germany; Prof. J. AFANASJEV, Gorki, Russia; Prof. BALLENEGER, Budapest, Hungary, Dr. H. BURGER, Zurich, Switzerland: Prof. A. de DOMINICIS, Portici, Italy; Prof. Ach. GREGOIRE, Gembloux, Belgium; Dr. J. HISSINK, Groningen, Netherlands; Dr. S. JOHANSEN, Stockholm, Sweden; Prof. P. KOETTGEN, Lich. b. Giessen, Germany; Dr. LAITSIKAS, Athens, Greece; Prof. H. LOUG, Berkeley, California, Prof. Dr. E. RAMANN, Munich, Germany; Dr. G. ROBINSON, Bangor, North Wales; Prof. Dr. K. ROERDAM, Copenhagen, Denmark; Prof. Dr. A. J. de SIGMOND, Budapest, Hungary; Dr. L. SMOLÍK, Brno, Czechoslovakia, SOKOLOWSKI, Moscow, Russia; Prof. P. VINASSA de REGNY, Parma, Italy; Prof. C. VIOLA, Parma, Italy; Prof. T. WESTERMANN, Copenhagen, Denmark; Prof. WIEGNER, Zurich, Switzerland, Dr. J. P. van ZIJL, Stellenbosch, South Africa; Prof. ZUNKER, Breslau, Germany.

The programme outlined at the Conference at Rome is being gradually realised. The Executive Committee are organising further comparative experiments on the preparation of soil samples for mechanical analysis (see also the appeal to members of the first Committee) in conjunction with the second Committee, which makes use of the same soils for its comparative analyses. A questionnaire was also prepared on the subject of the classification of soil particles, thus carrying out the earlier programme of the Committee; this classification will be introduced at an early date.

Dr. V. NOVÁK,
Chairman of the First Committee.

Request for Co-operation in International Comparative Analyses by Preparation of the Soil Samples for Mechanical Analysis. The first International Committee for mechanical and physical soil analysis resolved at the final sitting of the International Conference of Soil Science Rome on 16 May 1924: " To continue the comparative researches in different institutions with different methods of preparation ". The object of the comparative analysis is the accomplishment of the work outlined in the proposal for the unification of methods to be followed in soil science experiment stations.

Tests are to be made of the following four methods of preparation:

1. *without chemical reagents*:

(*a*) agitation in distilled water by means of an automatic shaker with a horizontal motion.

(*b*) two hours boiling of the soil samples in distilled water supplemented by repeated rubbing.

2. *with chemical reagents*:
   (*c*) English von HISSINK modified method.
   (*d*) ROBINSON method with hydrogen peroxide.

The institutions taking part are at liberty to investigate, if desired, other methods in addition to the above and to compare the results.

With this object the chairman of the Committee undertook to have four average soil samples sent to every institution making application. The types of soil were: 1 tropical soil, 1 alkali soil, 1 acid mineral soil and 1 Rendzina soil containing lime and humus. Each institution is however recommended to make tests at the same time of other types of soil specially characteristic of the environment.

The dimension of the soil particle is to be regarded as the most important point for comparison: its determination should correspond to 8 hours for time of sedimentation with 10 centimetres depth of liquid, at a temperature of 20°C. The dimensions of the particles must in any case be determined: if other qualities have to be determined, the scale 0.2μ, 2μ, 20μ, 0 2 mm., 2 mm., is recommended for the purpose.

The determination of the particles dimensions under the conditions stated is essential and should be effected on the basis of the sedimentation either by repeated decantation or by the pipette method, etc. Any apparatus may be applied which is found to be the most suitable in the institution itself.

Each institution furnishes a report on the analyses carried out, to the chairman's office of the First Committee, and all the reports are embodied in a memorandum. This memorandum is forwarded in good time before the beginning of the Congress to all members of the Committee, so that they may make a study of it before the meeting of the Congress.

The undersigned chairman of the International Committee for mechanical analysis permits institutions which are prepared to carry out analyses with soil samples prepared for mechanical analysis, to announce their readiness to co-operate up to the end of July 1925

Average soil samples will very shortly be sent out, and precise and detailed instructions, as to the methods as well as to the conditions which must be observed in all cases for the comparative analyses will be added.

Up to the present date the following institutions under expert direction have notified their intention of taking part in the work: Groningen (Dr. HISSINK), Munich (Dr. RAMANN), Giessen (Dr KOETTGEN), Breslau (Dr. ZUNKER) Budapest (Dr SIGMOND), Brunn (Dr. NOVÁK).

Dr. V. NOVÁK,
Chairman of the First Committee

Address: *Brünn, Kvetna* 19 (Czechoslovakia).

II. Committee for Chemical Soil Analysis. – The first meeting of the International Committee for Chemical Soil Analysis took place at Munich on 23 and 24 April 1914, and a report was included in the *Internationale Mitteilungen für Bodenkunde*, Vol. V, 1915. After that date the events of the years 1914-1918 brought about a serious interruption of the work. In 1922, however, at the Prague Conference, it appeared practicable to re-establish relations between members of the Committee, and as the outcome of joint work it was possible at the Conference in Rome in 1924 to pass several resolutions, which may be regarded as definite steps in the direction of establishing uniform analytic methods. These resolutions relate to the question of the preparation of the hot concentrated HCl. extract, as well as the chemical determination of the substances assimilable by plants.

The separate resolutions are as follows: (*a*) for the preparation of the hot concentrated HCl. extract the method of BEMMELEN-HISSINK is in principle adopted: only two questions in regard to the details of execution have to be agreed upon viz. the quantity of the acid and the length of time required for boiling. For the purpose of determining these points, the institutions which express their willingness to take part in the enquiry will have several kinds of soil sent to them.

(*b*) The subject of soil acidity gave rise to lively discussion and it was shown to be impossible to select a single method best suited to every case, owing to the fact that the different methods of determination give different indices of acidity. It is also proved that the acidity indices, although they afford a good indication of the lime requirements of the soil, can never give information as to the quantities of lime to be applied. On this account it is resolved to keep separate the questions of the acidity indices and the lime requirements. It is much to be desired that further work be done on this subject. Director HARALD R. CHRISTENSEN, Lingby, near Copenhagen, has undertaken the organisation of this work.

(*c*) As regards adsorption of bases the work of the Committee has so far advanced the problem that the possibility of devising a simple and rapid method of determining the exchangeable bases is becoming apparent. Dr. D. J. HISSINK has undertaken the organisation of these researches.

(*d*) The question of the determination of the nutritive substances assimilable by plants is one which is not yet sufficiently elucidated to allow the establishment of a simple method of determination to be contemplated. With a view to expediting the solution of the problem a resolution for collaboration with the Committee for the study of soil fertility was passed.

(*e*) It was also proposed to appoint a sub-committee for the alkaline soils, but as this subject also comes within the province of the Committee for Soil Classification and Nomenclature, the chairman of the Second Committee has come to an understanding with Prof. C. F. MARBUT and a proposal has been made for organising this Committee as a sub-committee of the fifth Committee.

In concluding this short report on the position of the work of the Committee it is satisfactory to note that the number of members, which at the time of its formation in 1910 was ten only, has now reached 64. The list of members is as follows:—

Chairman: A. A. J. VON S'IGMOND, Budapest.

Vice-Chairmen: B. AARNIO, Helsingfors; M. M. MACCOOL, East Lansing, U. S. A.; K. A. VESTERBERG, Stockholm; G. WIEGNER, Zurich.

Secretaries: R. BALLENEGGER, Budapest; N. M. COMBER, Leeds; TH. SAIDEL, Bukarest; E. SCHERF, Budapest.

Members: J. J. Always, St. Paul, U. S. A.; G. André, Paris; E. Billmann, Copenhagen; H.R. Christensen, Lingby; K. Daniel, Munich; J. Danzl, Munich; D. Digenty, Budapest; C. Duserre, Lausanne; A. Floderer, Magyaróvár; R. Gallay, Morges, R. Ganssen, Berlin; G. Garola, Chastres; Gedroitz, Nosoff; H. Gessner, Zurich; L. Gile, Washington; A Ch. Girard, Paris; K. Glinka, Leningrad; A. Gregoire, Gembloux; St. Haydin, Inareskakues; A. Herke, Szeged; D. J. Hissink, Groningen; H. Jenny, Zurich; Joffe, New-Jersey; A. F. Joseph, Khartoum; H. Junk, Munich; Kvas, Brünn; M. H. Lagatu, Montpellier; O. Lemmermann, Berlin; J. G. Lipman, New Jersey; A. Menozzi, Milan; E. Mitscherlich, Königsberg; L. F. Newman, Cambridge; B. Niklewski, Posen; E. Nyiredi, Budapest; C. Olsen, Lingby; J. Petersen, Ladelund; E. Ramann, Munich; N. Reitmaier, Vienna; N. Ritter, Bern; J. Rossi, Portici; E. J. Russell, Rothamsted; L. Salacz, Budapest; H. Sallinger, Munich; B. Schmitz, Oerlikon bei Zurich, O. Schreiner, Washington; L. Smolík, Prague; H. Stremme, Danzig; J. Szemian, Angora; O. Tamm, Alnarp; F. Terlikowski, Poznau; G. Tommasi, Rome; R. Trnka, Prague; A. Vendl, Budapest; W. Vernadski, Leningrad; A. Zoehls, Budapest.

(*Signed*) A.A. J. von S'igmond,	R. Ballenegger.
President of II Committee.	*Secretary of II Committee,*

Circular of the Second International Committee for the Study of Soil Chemistry on the question of the Preparation of Hydrochloric Acid Soil Extracts. — At the Fourth Congress on Soil Science at Rome the Second Committee passed the following resolution on the preparation of hydrochloric acid soil estracts.

" Before deciding finally on the adoption of the Bemmelen-Hissink, process it is advisable to ascertain :

1. If the respective quantities of the soil and of the acid should be those expressed by the figures 1 gm. of soil and 25 cc. of acid, or if the quantities corresponding to the figures 1 gm. of soil and 10 cc. are sufficient.

2. If a boiling for one hour is not enough instead of prolonging the boiling for two hours.

" To decide these two points it is necessary to make special experiments on samples of fine earth of various soil types, at least three kinds: acid, neutral and alkaline. »

" Members engaged in research work who desire to take part in this investigation are asked to address the chairman of the Second Committee, Prof. Alexius A. J. von Sigmond, Budapest, Hungary, 1 S'zent Gallért tér 4 ".

Members of the Committee who wish to take part are accordingly asked to put themselves in touch with members of the First Committee for the taking of soil samples. These samples will be forwarded on request to the chairman of the Second Committee. Members of the Committee are informed that in order to save carriage the investigations proposed by the First Committee for the Study of Soil Mechanics and Physics will be made on the same samples.

As regards the preparation of the acid extract, members are reminded that the original proposal made to the Congress by the Chairman of the Second Committee was in the following terms:

(*a*) 10-20 gm., of the soil sample are set to boil rapidly in an open flask on a naked gas jet with the addition of 25 times the volume of HCl. at a concentration of 25-35 % by weight, till the boiling temperature reaches 110°C. The time necessary should not exceed 25 minutes and can usually be reduced to 10 minutes. A reflux condenser is then placed on the flask and boiling over the gas jet is continued without interruption for two hours precisely. After two hours boiling, cold water is quickly introduced and the insoluble particles allowed to settle. Then the clear solution is decanted and the process repeated till the reaction of the filtered solution is only slightly acid. In this solution the content is usually determined of SiO_2, Al_2O_3, $Fe_2O_3(MnO_4)$, CaO, MgO,K_2O, Na_2O and P_2O_5.

(*b*) To remove from the insoluble precipitate the last remains of acidity a small quantity of Na Cl, is added and the lixiviation by decantation is continued until the reaction of the filtered solution is completely neutral. The insoluble residue is then dried over a water-bath, the filter paper with its inconsiderable contents is reduced to ashes and added to the insoluble residue. By this latter process the colloidal SiO_2 may lose something of its solubility in dilute alkali. To avoid this result care must be taken that only a very small quantity of the insoluble residue from the decantation reaches the filter paper. To dissolve in alkali the soluble SiO_2, it is shaken or stirred for five minutes at a temperature of 55°C. in an ERLENMEYER flask with 200 mm^3 of KOH of 1.04 specific weight. After five minutes cold water is poured into the flask and lixiviation proceeds with decantation as before, until there is no alkaline reaction, *i. e.* when there is finally added a small quantity of NaCl. In the course of the alkaline dissolution the percentage of SiO_2 is determined and, if present, also Al_2O_3 and other bases.

We are of opinion that it is sufficient to determine the quantity of silica soluble in the alkali and in the acid extract and to determine the total sesquioxides (F_2O_3, Al_2O_3) by precipitation in a warm solution of ammonia.

The detailed account of the method to be followed with the soil samples will be sent later.

Members are free to carry out also the determination of the other constituents or to try another process for the preparation of the acid extract, but in any case they are asked to carry out the determinations described.

Collaborators are asked to make their requests for soil samples before 1. September 1925.

Prof. Dr. ROBERT BALLENEGGER,
Secretary of the Second Committee.

Prof. Dr. A. A. J. VON S'IGMOND,
President of the Second Committee.

Sub-Committee for Alkali Soils. — The problem of the alkali soils is a world-wide problem, and its solution can be reached only with the collaboration of all who are working at the subject. Co-operation in the work of the Alkali Sub-Committee is therefore asked. The first step is to lay down the programme, and it will be helpful to receive a list of questions which it is felt should be made the subject of an international enquiry. It is recognised to be a great drawback to the work that the analysis of the alkali soils made in the different countries are not comparable, owing to the employment of widely differing methods. It appears that it would be advantageous to work out standard methods and an expression of opinion as to which methods should be adopted would be welcomed. The Second Committee for the Study of Soil Chemistry is working out a method for the digestion of soils with hydrochloric acid (method BEMMELEN-HISSINK) and this method might possibly be employed also in the case of the alkali soils. There is also the question of the terminology of the alkali soils, and it is felt that the knowledge of these soils would be advanced if every worker would give a description of the whole profile of the soil. Some agreement as to terminology would be necessary here.

It is considered also that it would advance the question of the reclamation of alkali soils if experiments on the same plan could be made in different parts of the world. But before undertaking this work on a large scale, it is important to gather all the available data on soil surveys in alkali districts.

Any suggestions that may be made on this subject will be very acceptable

Dr. ROBERT BALLENEGGER, Prof. A. A. J. VON SIGMOND,
Secretary, *Chairman,*

Alkali Soils Sub-Committee.

III. Committee for Soil Bacteriology. - A date early in July for a meeting of the Committee in Berlin will be fixed after consultation with the Chairman, Prof. STOKLASA.

IV. Committee for the Study of Soil Fertility. — No report has yet appeared.

V. Committee on the Nomenclature Classification and Mapping of Soils. — Prof. C. F. MARBUT, Washington, U. S. A. (Chairman).

Sub Committees.

(1) Sub-Committee for Eurasia on the Nomenclature and Mapping of Soils:

Dr. B. FROSTERUS, Finland (Chairman); Dr. D. K. GLINKA, Russia; Dr. S. MIKLASZEWSKI, Poland; Dr. H. STREMME, Germany; Prof. L. CAYEUX, France; Dr. O. T. TAMM, Sweden; Prof. W. WOLFF, Germany; Prof. V. NOVARESE, Italy. The committee will be still further enlarged by appointments made by the Chairman.

(2) Sub-Committee for Eurasia on the Mapping of Soils.

Prof. G. MURGOCI, Roumania (Chairman); Prof. W. WOLFF, Germany (General Secretary); Prof. L. CAYEUX, France (Treasurer); Dr. B. FROSTERUS, Finland; Dr. D. K. GLINKA, Russia; Dr. S. MIKLASZEWSKI, Poland; Dr. H. STREMME, Germany; Prof. PETER TREITZ, Hungary.

Additions to the membership will be made by the Chairman.

(3) Sub-Committee for the Americas on the Nomenclature and Classification of Soils.

Prof. C. F. MARBUT, Washington, U. S. A. (Chairman); Dr. P. E. BROWN, Ames, Iowa, U. S. A.; Prof. M. L. MILLER, Columbia, Missouri, U. S. A.; Dr. F. J. ALWAY, St. Paul, Minnesota, U. S. A.; Prof. A. R. WHITSON, Madison, Wisconsin, U. S. A.; Prof. G.W. CONREY, Columbus, Ohio, U. S. A.; Prof. C. F. SHAW, Berkeley, California, U. S. A.; Prof. W. L. POWERS, Corvalis, Oregon; U. S. A.; Prof. J. G. HUTTON, Brookings, South Dakota, U. S. A.; Prof. H. L. WALSTER, Fargo, North Dakota, U. S. A.; Prof. A. L. PATRICK, State College, Pennsylvania, U. S. A.; Prof. L. F. GIESEKER, Bozeman, Montana, U. S. A.; Dr. M.M. MCCOOL, East Lansing, Michigan, U. S. A.; Prof. R. S. SMITH, Urbana, Illinois, U. S. A.; Prof. H. O. BUCKMAN, Ithaca, New York, U. S. A.; Prof. A. W. BLAIR, New Brunswick, New Jersey, U. S. A.; Dr. G. E. CONDRA, Lincoln, Nebraska, U. S. A.; Mr. J. F. STROUND, Montgomery, Alabama, U. S. A.; Prof. L. M. CARTER, Athens, Georgia, U. S. A.; Prof. W. B. COBB, Chapel Hill, North Carolina, U. S. A.; Dr. G. S. GRAPS, College Station, Texas, U. S. A.; Prof. G. N. RUHNKE, Guelph, Ontario, Canada; Mr. A. H. HAWKINS, Saskatoon, Saskatchewan, Canada; Dr. AVELINO I de OLIVEIRA Rio de Janeiro, Brazil; Mr. Horace WILLIAMS, Rio de Janeiro, Brazil; Director Juan R. MONTES DE OCA, Buenos Aires, Argentina.

(4) Sub-Committee for the Americas on the Mapping of Soils.

Mr. J. W. MCKERICHER, Washington (Chairman); Mr. F. J. MARSCHNER, Washington; Prof. C. F. MARBUT Washington; Mr T. D RICE, Washington; Mr. W. E. HEARN, Washington; Mr. H. H. BENNETT, Washington; Mr. M. H. LAPHAM, Washington; Mr. M. BALDWIN, Washington; Prof. A. H. JOEL, Saskatoon, Canada; Prof. G. N. RUHNKE, Guelph, Canada; Dr. AVELINO I DE OLIVEIRA, Rio de Janeiro, Brazil; Director Juan R. MONTES DE OCA, Buenos Aires, Argentina.

This list will be completed later by adding names for Mexico, the States of Central America and of the other countries of South America.

Report of the Work of the Committee for the Agro-Geological Map of Europe, 1924. - In accordance with the resolutions of the Fourth and Fifth Committees on the International Agro-geological Conference at Rome on May 1924, a Committee has been formed for the preparation and publication of an international pedological map of Europe on the scale of 1 : 2 1/2 million as well as of the separate European countries in 1 : 1 ½ million. The headquarters of this Committee is Bucarest (W Soseaus Kisseleff 2), the chairman, Prof. MURGOCI, the vice-chairman, Prof. CAYEUX in Paris, the Secretary, Prof. WOLFF in Berlin, and members of the executive, Prof. FROSTERUS in Helsingfors, Prof. GLINKA in Leningrad, Prof. von MIKLASZEWSKI in Warsaw, Prof. STREMME in Danzig and Prof. TREITZ in Budapest.

The first business of this Committee was the issuing of directions for a uniform construction of the maps in the different countries. These directions have been very carefully drawn up by Prof. MURGOCI and brought out by Prof. TILL in Vienna under the title : " Instructions pour la préparation de la Carte Générale du sol de l'Europe " and forwarded to the individual members. It is proposed to send as supplementary aids to work a dictionary of technical terms in soil science in the languages concerned and a specimen map of the Rumanian plain and the Northern Dobrudscha, but these have not so far reached the members.

By the death of Prof. MURGOCI, who had devoted himself unreservedly to this work, the Committee has sustained a severe loss; it is now important, that all the preliminaries should be concluded, so that the coming summer may be fully utilised for the field work which is to be carried out in each country.

As regards work in Germany, a petrographic representation of the German soils on the principle of the international geological map is being prepared, and arrangements are in progress for a purely pedological survey of the country during the summer. W. WOLFF.

VI. Committee for the Application of Soil Science to Scientific Agriculture. — A report will appear in the next issue of this Review.

Personal.

G. M. MURGOCI,
GEOLOGIST IN CHIEF,
CHIEF OF THE SECTION OF THE RUMANIAN
GEOLOGICAL INSTITUTE,
PROFESSOR OF THE BUCAREST POLYTECHNIC SCHOOL,
CORRESPONDING MEMBER OF THE RUMANIAN ACADEMY,
CORRESPONDING MEMBER OF THE FRENCH ACADEMIE D'AGRICULTURE,
CHAIRMAN OF THE INTERNATIONAL COMMITTEE
ON SOIL MAPPING AND DIRECTOR
OF THE PEDOLOGICAL MAP OF EUROPE, ETC,

died at Bucarest on 5 March, at the age of 53 years.

An obituary notice will appear in the next issue of this Review.

Prof. R. GANSSEN, Divisional Director of the Prussian Geological Provincial Institute in Berlin and Director of the Pedological Laboratories celebrated his 60th birthday in March.

Dr. SOKOLOWSKY, of the Agricultural Institute at Kharkov, was appointed in August 1924 to the Executive Committee of the Soil Science Research Bureau, as Professor at the Agricultural Institute, as well as member of the Scientific Commission for Ukrainian Agriculture.

Errata.

In the article "Ein Beitrag zur Charakt. der Hannaboden" von V NOVÁK,, published in *Internat Mitt. f. Bodenkunde*, XIV, H. 3-6, under the illustration on p. 95, read Fig. 3 instead of Fig. 2, and on p. 103, Fig 2 should be substituted for Fig. 3.

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SPECIAL ACTIVITIES
OF THE BUREAU OF AGRICULTURAL SCIENCE OF THE INTERNATIONAL INSTITUTE OF AGRICULTURE

ENQUIRY ON LOCUST CONTROL.

LOCUSTS IN HUNGARY DURING 1924 (1)

HISTORICAL NOTE.

The locust invasion of 1924 was a continuation of that of 1923.

The Italian cricket (*Calliptamus italicus*) appeared, as usual, earlier than the Moroccan (*Dociostaurus maroccanus*). It was remarked from the first that, in those areas where systematic and scientific control had been established in the preceding year or where the locust parasite *Empusa* had then occurred, the locusts either did not appear at all in 1924, or only in quite small numbers. It is a curious fact that the fatal effects of the *Empusa Grylli* are entirely local. Thus in 1924 in Szaszberek (commune of Ujszász, Komitat of Jásznagykunszolnok), the following observations are made. Those farm areas which still include, even since the carrying out of the agrarian reform, several thousand Hungarian ' yokes ', were not infested in 1924 by the Italian cricket, although in 1923 a very serious invasion of this species had occurred, especially attacking the lucerne, and had subsequently, towards the end of July and during the month of August, been severely infected by the fungus already mentioned. On the contrary, in the areas which had not suffered from the Italian cricket in the preceding year and were attacked only for the first time in August by newly arrived swarms, the species appeared in large numbers in 1924.

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(1) This report, comunicated by the Royal Hungarian Ministry of Agriculture, is drawn up so as to follow on that of the previous year and at the same time forms the reply to the enquiry made by the International Institute of Agriculture For the terminology in regard to and the scientific names of the different kinds of locusts, compare the report of the author which appeared in the *International Review of the Science and Practice of Agriculture*, New Series, Vol. II, No 2, April-June, 1924: pp. 464-470.

This phenomenon was noticeable not only on a small scale, or in a hamlet covering some thousand 'yokes', but also on a large scale: whole groups of communes, which had been completely infested the year before, and where, though control had been very ineffectively carried out, the *Empusa* had occurred, were entirely free from the Italian cricket in 1924. On the other hand localities which had been completely free from the parasite in 1923 suffered very severely in 1924 from the locusts.

It should be noted that the appearance of the *Empusa Grylli* in 1923 was first remarked on 1 July, whereas in 1924 it was somewhat earlier. In 1923 however the development of the Italian locust was somewhat retarded, and the attacks of this *Entomophthores* thus affected the second larval or the first nymphal stages. In other words the locusts were only in the middle of their development cycle, and up to the end of September and later, the infection went on spreading to such an extent that on the tops of the lucerne or of the thistles (*Carduus nutans*) and any other tall stiff weeds, quite large clumps of dead locusts could be seen. In such a clump there would be found some young and some old locusts both male and female, bleached by rain and sun.

In 1924 the attacks of the *Empusa* were considerably more severe and areas not previously attacked by locusts were affected. In this season the dead dried locusts could be collected in sackfuls

No eggs had been laid by the locusts thus attacked, and by repeated investigation it was ascertained that, while the development of the eggs in the ovaries of the females had begun quite normally, and pairing had taken place, the eggs while still in the mother's body had become decomposed and reduced to a liquid state, and in a short time the interior of the locust was completely penetrated with the mycelium and choked with spores, or the surface of the body, particularly the delicate membrane connecting the joints of the abdomen, was entirely covered with the spores of the fungus, which at first were of a whitish colour and then gradually turned brown.

It should be noted that in spite of the severity of these attacks by *Empusa*, there remain wide tracts where the Italian locust appeared in large numbers and laid its eggs over considerable areas.

In 1924 on 22 July in the Commune of Tiszacsege (Kismajor farm *Komitat*, Hajdu), where great damage had been done to the tobacco crops by this locust, the writer was able to observe that pairing and egg-laying were in progress to an unusual extent over extraordinarily large areas. It may be mentioned that in 1924 the damage done to the tobacco crops by locusts was exceptional and, apart from the case just referred to, a large number of most promising tobacco plantations in the commune of Püdszentmihály (*Komitat* of Szabolcs) were ravaged by the Italian locust. It was not merely a case where as usual the lower older leaves were attacked, nor even of the finest leaves being riddled with holes as occurs if locusts are feeding : in this season on whole plantations nothing was left of the plants but the bare stems with a few young leaves on the top. The damage done to the favourite food plants of this locusts (lucerne and 'Mischling', a mixed sowing ofve tch, oats and barley), though in any case considerable, was perhaps on the whole in the year under report perceptibly less than in the preceding year.

It was even more noticeable in 1924 than in previous years that the lucerne fields of four years growth or more, suffered more severely than other areas where the growth of herbage was lower or less close, as in pastures and meadows, or on banks of canals and dykes.

No other observations of any importance were made.

The communes attacked by locusts of this species, as well as by the Moroccan species, are enumerated in the annexed table.

The Moroccan locust appeared in 1924 in the same localities as were attacked in 1923. No new observations were incorporated in the report for this only too well known locust.

It appeared on various large pastures, first on small patches and in inconsiderable numbers, and, as usual, little attention was at first paid to it. The areas attacked however became larger and merged into each other and the little 'hoppers' soon became a threatening swarm of all devouring locusts. Even in 1924 many communes did not ask advice in time, for the locusts on developing their wings deserted the arid pastures from which they had eaten every green blade and threw themselves upon the wheat fields. In consequence of this neglect at the earlier stage, from two to three thousand "yokes" of wheat were sacrificed. The greatest damage was done in the commune of Pély (*Komitat* of Heves), where the Moroccan locust has had for more than twenty years a hatching centre and is hence well known to the population on account of its repeated depredations.

An observation was made this year in regard to the development of this species of locust, viz. that any retardation in one phase is compensated for by more rapid development in the other phases. It was noticed for the first time that the Moroccan locust emerged from the ground at the end of April (27 April), and from the middle of June (10 June) became winged, its full development thus being reached in 44 to 45 days. In many seasons the young only leave the ground in the first ten days of May or even on 13 or 14 May: the first winged locusts however appear almost always on 10 or 11 June, which shows that the complete development may take place in these cases in periods varying between 28 and 38 days. Now it may happen that within the extreme limits of the period of development the locust may, so to speak, lag behind in one or other, sometimes in several, stages of its development, whether in the larval stage or that of the nymph, so that instead of taking 5 or 6 days nearly double that time is spent, before it reaches the next stage. It might be supposed that in such a case the whole period of the development of the locust would be so much longer. This however is not so, for when one or more phases are extended the successive stages up to the final transformation into the winged creature are correspondingly shortened

This circumstance originally misled the organisers of the control measures, and is still every year a source of miscalculation on the part of the threatened population. To it is no doubt due the fact that control is more or less unsuccessful, as the delay in development is apt to encourage the idea that there is more time for putting the measures into practice, an idea invariably contradicted by the facts On 10 to 11 June the first winged locusts always appear and become from day to day more numerous and about 29 June (the feast of SS. Peter and Paul) which is in Hungary according to the widespread popular idea the first day of harvest), there are often more vigorous swarms of flying locusts than ever, which in the days that follow become even more active and dangerous. It is from facts like these that one sees why any half measures at the beginning of control work out their own punishment before the end of the campaign, even in localities where it might be assumed that the population would have to be careful, if not on account of the damage to others, at least for their own sakes.

PERMANENT CENTRES OF INFECTION BY ITALIAN AND MOROCCAN CRICKETS " CALLIPTAMUS ITALICUS " AND " DOCIOSTAURUS MAROCCANUS ".

The writer is of opinion that, though the chief and original egg-laying centres of the locust are to be found in all the Mediterranean countries both North and South it has been for a long time established in Hungary and certainly earlier that the Moroccan species. Soil conditions in Hungary are more favourable for the Italian than the Moroccan cricket, the latter being specifically an inhabitant of salt lands.

The Italian cricket has been found throughout Hungary since the beginning of the twentieth century. In the mountain areas such as the Siebengebirge and Transylvania and also to the South of the Carpathians on the hills bordering on Pannonia, the cricket is only seen at intervals though frequently in undesirably large quantities. Large numbers are only to be found in the warm and too aften arid plains of the Alföld bordering both banks of the Tisza In all this vast region it has however been impossible to identify more than two permanent egg-laying areas. The more northerly, which may be called the infection area of Mátra is situated on the south eastern slope of the Mátra mountains in the area bounded by the Tarna and Laskó streams, its central point being in the Communes of Aldebrö and Nagytálya, both in the *Komitat* of Heves. The second is the River Tisza breeding ground lying to the South East of the former and extending on the left bank of the river over Tiszafured, Tiszaszöllös (both in the *Komitat* of Heves), Tiszaszentimetie, Tiszabud, Tiszalök Tiszabüra, Tiszaroff (in the *Komitat* of Jasz-Nagykunszolnok) and on the right over Tiszasüly and Kotelek (in the *Komitat* of Jásznagykunszolnok).

The fact that for over 40 years the Italian cricket has always not only made its first appearance but also is found in these regions in enormous numbers is in the author's opinion sufficient proof that they are the real centres of infection. Even though the adjacent districts are as a rule the first to be attacked from this source, this does not prevent the locust from increasing disastrously in more distant areas, where they always breed though less extensively. This consideration must always be borne in mind in the future from the point of view both of prevention and control.

On the other hand it cannot be said that there are in Hungary any permanent centres of infection by Moroccan crickets and the appearance of this species is of more recent date.

JOH. VON FRIVALDSZKY, the author of a study of the Hungarian orthoptera (1) refers to the *Dociostaurus* (Stauronotus) *brevicollis*, a species very similar to the *D. Maroccanus* Thb. and states that this species is smaller than *S. cruciatus* Ch., the true Moroccan cricket, which he also describes. FRIVALDSZKY himself with his colleagues of the National Museum of Hungary had at the time surveyed the whole country and collected considerable numbers of specimens of orthoptera in the districts in which *D. Maroccanus* Thb. *cruciatus* Charp. had periodically caused great damages since 1880. They however found no trace of the Moroccan cricket in these districts or in any other part of Hungary.

BRUNNER VON WATTENWYLL also makes no mention of the existence of this species in Hungary, though in his book (2) he gives a description of it and an account of its geographical distribution. He however informed Dr. GEZA VON HORVÁTH by a written communication dated 1 November 1920 that he had found specimens from 1862 onwards in the neighbourhood of Báziás on the left bank of the Danube on the confines of Old Hungary and Serbia, along the boundary lines of the *Komitats* Torontál and Krassó-Szörény. He also states that this species is to be found in Serbia according to information received from that country.

The first destructive invasion by the Moroccan cricket in Hungary took place in 1899 in the *Komitat* of Torontál which at the present time belongs to Yugo-Slavia, and in this area its ravages continued till the end of 1921 In the following years the infested area was divided up into allotments and brought under cultivation. For this reason the writer found in the summer of 1905 a small area only which could be described as dangerous as a possible centre of infection, although the species was still existent in a sporadic state. He is confident that this was the first infection centre for the Moroccan cricket in Hungary and that it has now been destroyed.

About the same time this insect caused damage in the neighbourhood of Szegd and in the surrounding *Komitat* of Csongrád, but the losses caused were slight and the development of cultivation soon put an end to the trouble.

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(1) FRIVALDSZKY JÁNOS, A Magyarországi egyenesropuek magánzajza (Monographia Orthopterorum Hungariae). Pest, 1867, p 1612

(2) BRUNNER VON WATTENWYLL C, Prodromus der Europäischen Orthopteren, p 130, Leipzig, 1922.

The breeding place, which has continuously since 1904 served as a permanent source of diffusion, is situated further North between the Communes of Jászkisér in the *Komitat* of Jászmagykunszolnok, Pély in the *Komitat* of Heves and, in a southerly direction, between Bessenyszög and Nagykörö in the *Komitat* of Borsod. This the writer describes as the Jazygier breeding ground. From this point the insect passes in a North Easterly direction, first by Tissafüred in the *Komitat* of Heves and then to the area between Mezökövesd and Emöd in the *Komitat* of Borsod where it forms a small but persistent breeding ground which is constantly renewed. This infection centre is the origin of invasions in another direction, passing by Tiszafüred but extending further eastwards. The swarms settle on the extensive natural pastures of Nagyhortobágy near Debrecen and also find in the neighbourhood another district of pasture land with an area of over 120,000 cadastral "yokes", forming a uniform plain marching with that of Nagyhortobágy, where a large infection centre is formed Northwards the extreme limits of attack are Budszentmihaly in the *Komitat* of Szabolcs, southwards, Dévaványa in the *Komitat* of Jásznagykunszolnok, in the West, Tiszafured in the *Komitat* of Heves, in the East, Balmazujvaros in the *Komitat* of Hajdu. This breeding ground however has up to the present, despite its large extent, only proved of secondary importance. It is impossible however to state that it will always remain so, for on one occasion it was the source of a particularly extensive invasion lasting for the three year period between 1905-1907. The future will show whether there will again be a similar outbreak and how serious. It should however be noted that the pasture lands of Nagyhortobàgy and neighbourhood have again been invaded for the whole period between 1921 and 1924 by the Moroccan cricket, but to so small an extent and so sporadically that so far it has not been necessary to institute any definite system of control.

The appearance of this species in Hungary is recorded in the statement to be found in the appendix.

In 1923 another variety of locust, *Orphania denticauda* Charp. appeared in Hungary and was a fresh cause of anxiety (1). It was also observed again in 1924, practically in the same districts as in the previous year but only in small numbers elsewhere (see appendix) and also in Slovakia, from which the writer received specimens marked as ' migratory locusts '. In Hungary this species has not been considered a serious danger, for the inhabitants of the area threatened knew by experience of the previous year that the insect was not particularly dangerous.

The ash grey migratory locust ' *Locusta danica* L. *Pachytylus danicus et cinerascens auctorum* ' made its appearance this year in the same areas as in the previous year (1). It appears to show a tendency to multiply in the areas that were attacked in the previous year, where only 170-200 specimens had been collected with great difficulty, whereas it was to be found by thousands in 1924. The number of communes affected has also increased, not only in Hungary but also, as shown by the detailed report annexed, in part of the *Komitat* of Bereg, which lies in Slovakia across the frontier. The writer however is of opinion that this species does not constitute any particular danger. In the first place this locust, though strong and destructive, is when compared with others comparatively innocuous. Secondly their breeding places, swamps damp meadows and uncultivated lands, are of small extent in the district where they were found in the previous year, and all the surrounding area has for a long time been under permanent cultivation.

In 1924 however it was discovered that a species of prairie grasshopper, a locust in the original sense of the name, which had hitherto been considered to be harmless, was capable of becoming dangerous in certain conditions. In the areas attacked partly by the Moroccan cricket, for example, Karcag in the *Komitat* of Jász-nagykunszolnok, and partly by the Italian cricked (for example, Szászberek in the same *Komitat*), certain *Chelidoptera* (*Platycleis*) appeared, and amongst these the *Ch. albopunctata* Goeze (*Pl. grisea*) Fab.) was the cause of serious damage.

It should be stated that in Hungary several varieties of these *Chelidoptera* are found and that if the true dangerous locusts appear in large numbers the native grasshoppers are also as a rule very numerous. They however remain harmless and live and spend all their time in the pasture lands. Occasionally however they have shown themselves in the wheat and barley fields after harvest, where they find a lodging in the sheaves which are known in Hungary as Kreuz. These insects which were at the perfectly mature stage at times collected in large numbers and devoured the grain in the ear. For this reason the *Platycleides* are known in Hungary as the 'hoppers, that eat the corn ears'. The damage done however has never been considerable. In 1924 however various kinds of cereals, especially wheat and barley, while still in the green stage, were attacked, not by the adult insects but by the nymphs and larvae. As a rule they only ate the grain when still in the milky stage, but to such an extent as to bring about a loss of nearly 100 per cent.

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(1) See *Inter. Rev. of Sc. and Practice of Agric.* Vol II (1924), No. 2, p 465 and ibidem. pp. 467-468.

On investigation of this new phenomenon it was clear that the cattle of the pasture lands were the ultimate cause of the trouble, as they gradually forced the *Platycleides*, while still in the immature stage to leave the pastures so that they settled on the neighbouring crops. As this process of expulsion lasted for several weeks, in the end the 'hoppers' were found to have disappeared entirely from the pastures to find a lodging among the cereal crops. Frequently they confined their depredations to the borders of the fields, but on occasion they penetrated as far as 100 or 200 paces from the edge, leaving their mark on each ear, and in many cases consuming every grain in the ear Control of these 'hoppers' in a cornfield is impossible, and they cannot be hunted out like true locusts. They jump from the ears in among the corn and conceal themselves on the ground. The only thing to be done is to harvest the field as quickly as possible in order to save what remains

The pasturing cattle may in the same way oblige the Italian and Moroccan crickets to take refuge in the cereal crops, but as regards the Moroccan species up to at least 50 % to 60 % can be driven out again if sufficient care and patience are exercised. It also often happens that this cricket abandons the corn field of its own accord after a short stay, and thereupon can be exterminated without difficulty. This is however far from being the case with the *Platycleides*.

LOCUST CONTROL, ITS PRACTICAL RESULTS AND OUTLOOK FOR THE FUTURE.

The sole alteration made by the State authorities in the organisation of the control measures, necessitated by the widespread danger was that the control of the Italian crickets was to be organised and directed by the communes themselves, and that the necessary expense must also be met locally. The measures against the Moroccan cricket were organised and directed by State experts, the salaries, etc., of the experts, and the railway transport of the control apparatus, machines, etc., paid by the State, but the actual labour, including supplies as well as wages, defrayed by the communes. A proposal was submitted to the Hungarian Parliament at the end of 1924 for the alteration of the Landgesetz (agrarian law) No. 31 of the year 1907, as also of the ancient custom in this respect.

The control measures remain the same as in 1923, and on the whole have given satisfactory results, except, as has already been said, in one commune, Pély (*Komitat* : Heves), where very considerable damage was caused by the Moroccan cricket, in consequence solely of local negligence and procrastination. The damage thus done to 2-3000 " yokes " in itself represents at the present wheat prices (beginning of 1925) a loss of 5 to 7.5 millions of Hungarian crowns It has been noted that the successful campaign of the preceding year partially ensured the success achieved in 1924 and that the *Empusa* or locust fungus did much to contribute to the destruction of the Italian cricket.

A strict estimate of the Government expenditure in 1924 was 100 million Hungarian crowns (paper) ; it was impossible to estimate the cost to the communes.

As regards the work to be done in the future, the first essential is that the people themselves should be thoroughly and unceasingly instructed as to the different kinds of locusts and the method for their control : in the second place that all administrative provisions should from the very first appearance of the locusts be put into force and carried through, so that a thorough control may be exercised over the young locusts and over small affected areas. But this is only possible if the organising authority can act on its own initiative and has the necessary means at its disposal, if the control measures are vigorously carried out and the officers in charge are in their places day in and day out, and thus all available forces can be utilised at the right moment.

The Royal Hungarian Ministry of Agriculture has issued control instructions for the information of the population threatened by locust invasions. Two publications have appeared ; the first gave a survey of the present situation as regards locusts with an account of the appearance of the different kinds and a statement of the rules to be followed in the campaign against the danger. The second contains an announcement of the preliminary measures proposed. The author of this publication is the writer of this report.

Detailed Information regarding the Locust Invasion during 1924 in Hungary

No.	Communes	Komitats	Moroccan Crickets	Italian Crickets	Remarks
1	Gagybátor	U Akauj		+	
2	Felsokazsmárk	»		+	
3	Pusztaszikszó	»		+	
4	Gyoma	Békés	+		
5	Szeghalom	»	+		
6	Bekessámson	»			
7	Füzesgyarmat	»		+	
8	Mezobereny	»		+	
9	Vészto	»		+	
10	Gyula	»		+	
11	Bucsatelep	»		+	
12	Bekes	»		+	
13	Gyulavári	»		+	
14	Doboz	»			
15	Báránd	Bihar	+		
16	Zsadány	»		+	
17	Nagyléta	»		+	
18	Okány	»			
19	Mezopeterd			+	
20	Bojt	»		+	
21	Biharnagybajom			+	
22	Hosszuhát	»		+	
23	Nagyrabé	»		+	
24	Szalonta	»		+	
25	Sárrétudvari	»		+	
26	Biharkeresztes	»		+	
27	Nagykereki	»		+	
27 *b*	Szerep	»		+	
28	Magyarhomorog	»		+	
29	Komádi	»		+	
30	Berekboszormény	»		+	
31	Geszt	»		+	
32	Korosszakál	»		+	
33	Puspokladány	»	+		
34	Emod	Borsod	+		
35	Szentistván	»	+		
36	Gelej	»	+		
37	Mezocsát	»	+		
38	Mezokovesd	»	+		
39	Igrici	»	+		
40	Tibolddaróc	»		+	
41	Miskolcz	»		+	Locality Csaszta puszta
42	Szihalom	»		+	

No.	Communes	Komitats	Moroccan Crickets	Italian Crickets	Remarks
43	Szakáld	Borsod		+	
44	Keresztespüspöki	»		+	
45	Boldva	»		+	
46	Lajosszalonta	»		+	
47	Tiszaszöllös	»		+	
48	Nagylak	Csanád		+	
49	Makó Kunágota	»		+	
50	Csanádalberti	»		+	
51	Hódmezövásárhely	Csongrád		+	
52	Szentes	»		+	
53	Fülopmajor	Fejér		+	Locality. Pátka
54	Csákvár	»		+	
55	Csókakö	»		+	
56	Tarjánpuszta	Györ		+	Pannonhalma
57	Pér	»		+	
58	Mezöörs	»		+	
59	Bonyrétalap	»		+	
60	Püspöktelep	»		+	
61	Kaba	Hajdu	/	/	Kiskaba
62	Macs	»	/	/	
63	Nádudvar	»	/	/	
64	Hajdusámson	»		/	
65	Hajdubószormény	»		/	
66	Hajduszoboszló	»		/	
67	Balmazujváros	»		/	
68	Földes	»		/	
69	Nagyiván	Heves	+		rare
70	Tiszafüred	»	+	+	rare
71	Poroszló	»	+		
72	Karácsond	»	+		
73	Aldebrö Feldebrö	»	+	+	
74	Sarud	»	+	+	
75	Ujlörincfalva	»	+		
76	Pély	»	+		
77	Kisköre	»	+	+	
78	Visznek	»	+	+	

No	Communes	Komitats	Moroccan Crickets	Italian Crickets	Remarks
79	Boczonád	Heves	+	+	
80	Tiszanána	»	+		
81	Hidvég	»	+		
82	Tarnaszentmiklós		+		
83	Mezotárkány	»		+	
84	Nagytálya			+	
85	Recsk	»		+	
86	Abasar	»		+	
	Markaz				
87	Domoszló	»		+	
	Matraszollos				
88	Gyongyospuszta	»		+	
89	Pásztó	»		+	
90	Kisnana			+	
91	Tarnaors				
92	Erdötelek			+	
93	Kerecsend				
94	Kompolt	»			
95	Tarnamera				
96	Heves				
97	Feldebro			+	
98	Erk			+	
99	Verpelét				
100	Adacs				Locality Olgamajo
101	Vecs			+	
102	Nagyfuged			+	
103	Hatvan	»		+	
104	Eger	»		+	
105	Atkar			+	
106	Devavanya	Jász-Nagy-Kun Szolnok	+		
107	Torokszentmiklós	»	+		
108	Jászapáti	»	+		
109	Jászkisér	»	+		
110	Nagykorü		+		
111	Kötelek		+	+	
112	Besenyszog	»	+	+	
113	Tiszaroff	»	+	+	
114	Karcag		+	+	and *Platycleis*
115	Kisujszállás (Csudaballa)	»	+	+	
116	Gyoma		+	+	
117	Turkeve		+	+	
118	Pusztatenyö	»		+	
119	Tiszaderzs	»		+	
120	Alattyán	»		+	
121	Tiszaszentimre	»		+	
122	Kunmadaras			+	

No	Communes	Komitats	Moroccan Crickets	Italian Crickets	Remarks
123	Fegyvernek	Jász-Nagy-Kun-Szolnok		+	
124	Mezotur	»		+	
125	Tiszavarkony	»		+	Felsoszászberek Farm. *Platycleis* sp.
126	Jaszberény Ujszász	»		+	
127	Mesterszállás	»		+	
128	Szajol			+	
129	Szolnok	»		+	
130	Kunhegyes	»		+	
131	Tiszasas	»		+	
132	Jásztelek	»		+	
133	Jaszdozsa	»		+	
134	Czibakháza	»		+	
135	Mocsa	Komarom		+	
136	Balassagyarmat sziráki járás	Nógrád		+	
137	Kallo			+	
138	Bujak			+	
139	Kisterenye			+	
140	Zagyvapalfalva			+	Kokut Farm.
141	Penz			+	
142	Alsópeteny			+	
143	Salgótarjan	»		+	
144	Tahitótfalu	Pest	+		Infrequent
145	Gomba	»	+		
146	Okecske	»		+	
147	Jászkarajenö	»		+	
148	Mende	»		+	
149	Gyomro	»		+	
150	Ujkecske	»		+	
151	Nagykoros	»		+	Tetetlen Farm.
152	Kiskoros	»		+	
153	Godollo	»		+	
154	Pusztavacs	»		+	
155	Büdszentmihály	Szabolcs		+	
156	Tiszadada	»		+	
157	Tiszabüd	»			
158	Polgar	»		+	
159	Tiszadob	»		+	
160	Tiszaeszlár	»		+	
161	Tiszalok	»		+	
162	Pap	»		+	
163	Ujfehértó	»		+	
164	Mékcse	»		+	

No.	Communes	Komitats	Moroccan Crickets	Italian Crickets	Remarks
165	Nyirgyulaj . . .	Szabolcs		+	
166	Királytelekpuszta	»		+	
167	Szombathely	Vas			*Orphania*
168	Enying .	Veszprém		+	
169	Hajmásker .	»		+	
170	Hernádnémeti	Zemplén		+	
171	Kesznyéte .	»		+	
172	Alsóberecki	»		+	
173	Girincs	»		+	
174	Becsked	»		+	
175	Pácin .	»		+	Locality Sárospatak
176	Olaszliszka	»		+	
177	Boldva	Borsod	—	—	*Orphania*
178	Banréve .	Gomör	—	—	»
179	Kéthely .	Somogy	—	—	»
180	Nagydobos .	Szatmár	—	—	*Locusta danica*
181	Gyalóka . . .	Sopron	—	—	*Orphania*
182	Felsoszakony .	»	—	—	»

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BIBLIOGRAPHY.

1. J. JABLONOWSKI, Tájékoztató a hazai sáskaállaporról kulonöstekintettel az olaszsaska irtasára. (The present position as regards the locust peril with special reference to the control measures against the Italian cricket). Budapest, 1924.
2. J. JABLONOWSKI, A sáskajárás elötti (How to guard against the locust peril). *Koztelek,* (Year 34), No. 38-39, p. 485, 1924.
3. J. JABLONOWSKI, A sáskajárás utáni (After the locust invasion). Ibid. (Year 34), No 52, pp. 645-647, 1924.

Locusts in the Colony of Eritrea.

Report from the Government of Eritrea, transmitted to the International Institute of Agriculture by the Italian Colonial Minister.

During 1924 no flights of locusts took place throughout the Colony of Eritrea. Only in the valley of Barca was an excessive multiplication of some local and sedentary species noticed, of which *Tryxalis variabilis* was the most numerous and caused slight injury to the durra crops, attacking the still immature cariopses.

Knowledge as to the directions from which the invasions come, the zones of multiplication, dominant species and biology, is limited therefore to what it was possible to ascertain up to 1916, the year of the last invasion.

Reports of the invasions which took place from 1902 to 1916 were transmitted to the International Institute of Agriculture, which published a monograph (1) on the subject

The experience of past years shows that the Colony is subject to invasions from the south and south-east, coming from the Sudan, and that the coast region from Zula-Sahel to the Sudanese frontier is a zone of winter reproduction

The control of locusts therefore necessitates careful vigilance and prompt reporting of flights, the zones of oviposition and the appearance of the young larvae

The Heads of Districts and Territories and those engaged in the various Colonial Services are required to transmit these reports to the nearest district politico-administrative authority, who must in turn take prompt measures to advise the Government and all the other District Authorities and to organise control measures, employing the natives and with the aid, when necessary, of military detachments

Owing to the local and demographic conditions of the Colony, the work cannot be carried on except by the destruction of the eggs and the locusts in the first stages of their life

The measures taken and instructions given by the Government at the beginning of each agricultural season, and by the District Commissioners by means of proclamations, are based on these conditions

Locusts in Italian Somaliland (2)

Communicated by the Government of Italian Somaliland and transmitted to the International Institute of Agriculture by the Italian Colonial Ministry

The last noteworthy invasion of locusts in Italian Somaliland took place in 1913.

Others had previously ocurred within a comparatively short period, namely in 1912 and 1905. These invasions, according to the reports, all came from Abyssinia, and this is also confirmed by the fact that, in 1905, the invasion occurred simultaneously, both in south Somalidand and in Eritrea.

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(1) International Institute of Agriculture *Control of Locusts in Various Countries.* Rome 1916.

(2) See also: *R.* 1924, No 1032. (*Ed. note*)

The damage done in every case was very great. In fact, both wild and cultivated plants on the route taken by the locusts were almost always totally destroyed. This route terminated in every case at the Benadirian coast of the Indian Ocean, in the waters of which most of the locusts were drowned.

Apart from the above instances, no other invasions took place, either small or great, which was fortunate for agriculture in the Colony.

Locusts are included among the insects living in a non-migratory state in the various parts of Somaliland ; they are in such small numbers however and so dispersed over vast areas that they need not be taken into consideration, and this is true to such an extent that among the enemies which annually damage fields and crops, locusts cause the least injury.

Grasshoppers on the other hand cause comparatively greater damage than locusts, by biting off and devouring the tender shoots, but on the whole these also exist only in negligible quantities.

The year 1924, like the ten preceding years, closed without any locust invasion being recorded in the neighbouring countries and without any reawakening of activity on the part of native locusts in Italian Somaliland.

Locusts in Egypt.

Communicated by the Royal Egyptian Legation in Rome. to the International Institute of Agriculture

No invasion of locusts in any part of Egypt was reported during the year 1924, and circumstances have not called for researches of a technical, scientific, legislative or administrative nature, as no species of injurious locusts exist permanently in the country.

ENQUIRY ON THE OLIVE FLY.

Control of the Olive Fly (*Dacus Oleae*), in Turkey.

Communicated by the Turkish Ministry of Agriculture to the International Institute of Agriculture.

In 1924 measures against the " olive fly " (*Dacus oleae*) were carried out in the following districts of Turkey : Baldjova, Bodja, Manissa and Karessi near Smyrna ; Esine, Lapseki and Bairamidj near the Dardanelles ; and Moudania, Kemlik and Chrhan Gazi near Broussa.

The spraying method was used (arseniate of soda, molasses and water).

The work was begun on the 15th May and continued on days when no rain fell.

The results obtained were satisfactory; 80 % of the olives reached normal size and remained healthy.

The work will be continued during the year 1925, and more improved methods will be adopted.

ENQUIRY ON TESTING OF DAIRY COWS.

New Annual Enquiry.

In pursuance of the resolution passed at the last General Assembly of the International Institute of Agriculture, held in May 1924, Enquiry XXIX has been sent out with date 30 March of the current year. The object of this Enquiry is to collect information as regards the development of dairy cow testing in each year, and the results obtained. The questionnaire has been sent to the 71 countries adherent to the Institute, as well as to 44 other States and Colonies.

AGRICULTURAL INTELLIGENCE

AGRONOMY.

Soil Science.

See *R.* Part II, *Proceedings of the International Society of Soil Science,* Abstracts.

Fertilisers and Manures.

268. **Fertilizers and Fertilizing.**

FORTI CESARE. I concimi e le Concimazioni *Nuova Enciclopedia Agraria Italiana.* 1 Vol., 8 vo, 362 pp, figs 131, 3rd ed. Unione Tipografico-Editrice, Torino, 1924.

In the first part of this volume of the " Nuova enciclopedia agraria italiana " the author examines the elements of fertility, taking under consideration the cycle of organic and mineral substances. An examination of inorganic and mineral fertilisers (nitrates, phosphates, potash and lime) is given, describing briefly in each case the method of manufacture, properties and uses, not omitting compound, complex and catalyptic fertilisers.

Part III, deals with organic fertilisers and after treating of green manuring, farmyard manure is discussed, its production, storage, value and use in agriculture ; the author then studies fertilisers derived from human excrement, sewage, industrial residues and waste.

Finally, there is the practical application of fertilisers, in which, from the knowledge of the action and quality of fertilisers and the nature of the soil, the formula for fertilising is deduced. The method of application, controlling and trade, form the subject of a further chapter after which follows statistical information, derived in great part from the publication of the International Institute of Agriculture, " *World Production and Consumption of Chemical Fertilisers.* " A. F.

269. Chemico-Physical Influences of Lime and Calcium Carbonates on Soil.

RAMANN, E. (Forest Experiment Station, Munich, Germany). *Soil Science*, Vol. XVIII, No. 5, pp. 387-400. Baltimore Md., 1924.

The application of lime causes changes in the soil which are much more complicated than has been realised up to the present, and which depend not only on physical conditions, but also on the chemical composition of the soil itself.

The flocculating influence shows itself when the re-expansion value of the solution has been regained. Compared with the re-expansion value of quartz which is 0.013 qm. per litre, in a soil with 20-30 % of moisture, the quantity of lime necessary for precipitating a litre of soil (s. g. 1.5) is 0.0025 gm.-0.004 gm., which corresponds to an application of 5-10 kg. of CaO per ha. This quantity corresponds to a P_H of 10.5. The flocculating effect, once obtained, continues, provided it is not interfered with by mechanical influences; the crumbling of the soil continues even when the lime has been transformed into carbonate, which, in turn, favours crumbling. A certain quantity of lime, however, should always remain in the soil, to ensure the necessary physical reaction. In view however of the unfavourable influence of the alkaline reaction on the majority of crops, it will be necessary to apply the quicklime very early, so that at the beginning of the growth period the greater part should have already been precipitated as carbonate.

Considerable quantities of calcium hydroxide are combined in the soil by adsorption and the exchange of bases. By adsorption the soil solution loses its bases and loses more or less of its influence on plants. The exchange of bases is rendered easy in acid soils, in which fertilising with quicklime is useful; this is not the case in silicate soils should they contain exchangeable potassium or sodium. In such cases the lime will replace the potassium and sodium, and these in turn pass into solution as hydroxides, which are notoriously harmful to growth even in low concentrations. In the presence of these the alkalinity of the soil continues much longer, because the alkalies are not precipitated by the carbonic anhydride, as happens in the case of lime.

It is clear therefore that the lime may cause serious harm if it has been preceded by potash fertilisers; in such cases the harmful factor is not the lime, but the alkaline hydroxides which have formed. The lime therefore should be applied so that the soil can absorb it as well as the alkaline hydroxides formed. Lime fertilising, in order to be scientific, should be preceded by an examination of the soil, of its degree of saturation and exchange of bases.

Another important point, not yet investigated, is the decomposing influence of the quick-lime and hydroxides on the silicates, and the transformation of the lime absorbed.

The well-known influence of quick-lime as a fertiliser becomes obvious. It should not however be applied in larger quantities than the soil can adsorb, and it should always be applied in smaller quantities than those usually estimated. The simultaneous application of potash salts, and especially of kainit, should be absolutely avoided ; it is advisable to apply lime in autumn and potash in spring.

With the application of carbonate of lime, and especially of marls, the influence is durable but slow. The soil silicates, which lose their bases in the exchange, regain their influence, while the soil texture is also improved. The neutralisation of the soil is effected by transforming the carbonate of lime into acid carbonate. The crumbling influence is not very great, because the acid carbonates act as neutral salts, while the concentration of the greater part of the soil solution does not reach the re-expansion value of the salt. On the other hand there are considerable physical and perhaps also chemical influences through the formation of carbonate of lime from the bicarbonate.

The influence of quick-lime, however, cannot be considered as equal to that of carbonate of lime, as the physico-chemical influences of the former are quite different, since it has a great influence on the soil equilibrium. Both, however, are considered to be great improvers of the soil, but are less important from the point of view of nutrition. They should be applied after a careful examination of the soil conditions. A. F.

270. The Effect on Soil Reaction of Long-Continued Applications of Calcium and Magnesium.

BURGESS P. S. *Soil Science*. Vol. XVIII, No. 3, pp. 169-172. Baltimore, M. 1924.

An account of tests made during a period of 15 years, the results of which show that the maximum neutralising effect is obtained with magnesium hydrate, followed by calcium hydrate. Next in order follow finely-ground magnesian and calcium limestone. A. F.

271. Synthetic Calcium Silicate as a Source of Lime for Soils.

BARNETTE, R. M. (New Jersey Agricultural Experiment Station). A Comparison of the Influence of Synthetic Calcium Silicates with other Forms of Lime as Affecting Plant Growth. *Soil Science*, Vol. XVIII, No. 6, pp. 479-491, tables 6, Bibl. Baltimore Md., 1924.

Synthetic calcium silicate is a product containing 80 % of di-calcium silicate and relatively large percentages of sodium and aluminium compounds as impurities. Another silicate with which the author has made experiments is the so-called " limosil " prepared in a process for the recovery of potash from glauconite : it contains about 13 % free lime in the form of calcium hydrate.

The following are the general conclusions drawn by the author from his experiments :— Both these silicates are as effective as the common forms of lime when applied to so-called acid soils, on an equivalent CaO basis. There is an exceptional increase in the growth of barley on soils treated with di-calcium silicate, and the greater barley yields obtained are probably due to the greater absorption of the silica, resulting in a healthier and heavier plant.

The results obtained as regards nitrogen percentages in the crop are similar to those accompanying the other preparations of calcium.

A. F.

272. Mauritian Pen Manure.

HARDY Prof. F. *Tropical Agriculture*, Vol. I, No. 8, pp. 116-118. Trinidad, 1924.

The author alludes to the method evolved at Rothamsted for making artificial manure by treating straw with water, ammonium sulphate and ground limestone, and then describes a practice carried out by planters in Mauritius whereby the output of pen manure may be largely increased.

The practice consists in spreading machine-cut cane trash, herbage or bush to a depth of about 2 feet in a covered pen. Cattle are turned into the pen daily for 14 days. The urine soaked litter is then transferred to a pit, with stone or concrete floor and sides, in which the material is stacked, the process being repeated until the pit is full. When the mass has broken down the manure is carted into the fields.

The end product is not only in a form suitable for the land, but contains much greater amounts of nitrogen than were originally present, owing to the work of nitrogen-fixing bacteria.

The Mauritius method enables large quantities of manure to be made with a limited number of animals, and very diverse kinds of cellulose material may be employed. The most serious disadvantage is the initial cost of the trash cutter, pen and pit, and the handling of the material.

The author gives data relative to an experiment made in Trinidad: the pen measured 100 feet by 30 feet, divided into two compartments; alongside the pen was the pit, 100 feet by 20, by 6 feet deep, made of concrete, the whole being covered by a roof.

Twenty cattle were turned into one compartment of the pen for 14 days, after which the second was used, the contents of the first being transferred to the pit. By this plan, 2000 tons of manure per annum can be made by 20 cattle, or 100 tons per head, as compared with 20 tons per head by the ordinary method.

Analysis showed that the manure differs little, if at all, from that prepared in the usual manner. It was found that a storage in the pit of one week is sufficient for the production of a satisfactory manure.

W. S. G.

273. The Availability of Nitrogen in Peat.

LIPMAN C. B. & WANK M. E. (University of California). *Soil Science*, Vol. XVIII, No. 4, pp. 311-316, figs. 2, bibliography. Baltimore, Md., 1924.

From the authors' growth tests, peat, whether treated or not treated with acid and subjected to steam pressure, is not a source of available nitrogen.

A. F.

274. Marine Fertilisers in Galicia (Spain).

ROF y CODINA, Prof. Juan (Inspector de Higiene y Sanidad Pecuaria). *El Cultivador moderno*, Year XIV, No. 8, pp. 12-13, figs. 2. Barcelona, 1924.

In addition to the increasing quantities of chemical fertilisers used by the farmers of Galicia, such as superphosphates, basic slag, potassic salts and other fertilisers, manure is still produced in large quantities, and shell sand, sea-weed, and fish residues are also employed

Shell sand. — From the sea-beaches opposite the breeding-grounds or banks of molluscs, during the spring and summer, are taken the sand and detritus washed up by the sea, together with quantities of chalk, sometimes above 70 %; this sand also contains 1 % of phosphorus and some potash. Lime and phosphorus being very scarce in Galicia, the utility of this sand for crop cultivation will be readily understood, in addition to the improvement it causes in the texture of soils very rich in humus. Only sands of the finest grain are utilised. Although the carbonate of lime and the phosphorus they contain are in a somewhat insoluble form, the carbonic acid of the air and that secreted by plant roots, in addition to other acids, attack and make soluble these salts, hence the smaller the grains the larger is the surface they present and the more rapidly will they be dissolved.

Sea-weeds. — The sea-weeds *fucus* and *laminarius* are found both at the bottom of the sea, in the mouths of rivers and on the surface of rocks washed by salt water. The high tides in summer detach large quantities of sea-weed, which are washed onto the beach, as is the case with the storms in winter. These sea-weeds form a good fertiliser, as they contain nitrogen, potash, phosphoric acid and lime in varying quantities, in addition to which the cost of collecting and transport is negligible. They are used green after being drained of salt water; some farmers mix them with organic fertilisers, and others dry the weed more carefully after removal of the sodium chloride contained on being first taken from the sea. The weed is used as a substitute for manure by farmers who possess no livestock.

Crustaceans. — At the mouths of rivers in Galicia, there are in some places masses of crabs, especially in summer, in Sada, Betanzos, Puentedeume, Ferrol, Cedeira, Coruña, etc. The crabs are easily gathered and are sold to the farmers, who call them "*pateixo*", which is an excellent fertiliser, rich in phosphorus and lime. If the crabs, are dug into the soil immediately after being gathered, their decomposition is slow, hence it is usual to spread them over the soil until patches are shown around the "pateixo", caused by fatty matter, and the "pateixo" is then ploughed in. Crops sown on soil which has been treated with this fertiliser, are easily distinguished from neighbouring crops, by their better development.

Fish residues. — The large quantities of residues from the pickling, preserving and salting factories which abound in Galicia, applied as fertilisers, are buried immediately in the soil. The author mentions the various kinds of residues utilised, and considers that it would be better to treat them first with steam under pressure, to free them from acids and then, when dry, to reduce the mass to powder, as transport and preservation in this state would be much easier. Part of this fish powder might be used as a cattle-feed. The necessity is shown of establishing similar industries to those found at the French fishing ports, in Galicia at such ports as Vigo and Coruña.

The author draws attention to the importance for Galicia of such industries as could be founded on the abundance of the coast products, which are utilised to-day, but only in their crude state; it is probable that "*pateixo*", reduced to powder, would form a useful cattle-feed when used in conjunction with other fish residues. E. M. F.

275. The Present Trend of Developments in the Nitrogen Problem.

BRAHAM, J. M. Abstract from *Industrial and Engineering Chemistry*, Vol XVI, No. 12, p. 9, figs. 3 Washington D. C., 1924.

The nitrogen problem is of the utmost importance, from the military point of view, in the manufacture of explosives, as also from the agricultural point of view and, consequently, in the question of food supply all over the world.

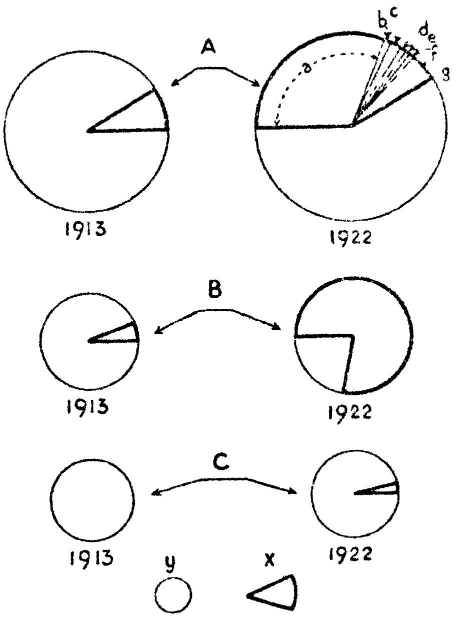

FIG. 91. — Relation between the production of fixed atmospheric nitrogen and the total consumption of inorganic nitrogen.

A. = the world; *a* = Germany; *b* = United States; *c* = Norway; *d* = Japan; *e* = Italy; *f* = France; *g* = other countries. B. = Germany; C. = United States; *x* = production of synthetic nitrogenous manures; *y* = consumption of mineral nitrogenous fertilisers.

The atmospherie nitrogen industry which began only about 20 years ago, now produces 500,000 tons of nitrogen annually, equivalent to about 3,300,000 tons of Chili nitrate of soda and almost half the world's production of inorganic nitrogen. In 1922, 75 % of the total output of fixed nitrogen was produced by Germany.

The three chief methods of nitrogen fixation are:

Electric Arc. Produces annually 36,000 tons of nitrogen, of which, 95 % is obtained in Norway. The principal obstacle to production is the enormous quantity of energy required, hence it cannot be adopted except where electric energy is very cheap.

Cyanamide Process. Requires less than a quarter of the energy needed by the foregoing and is therefore more widely adopted. The present production is

140,000 tons annually, about four times that produced in 1913. The chief disadvantage is that calcium cyanamide is by no means a satisfactory fertilising material, while the cost of converting into other substances (sulphate of ammonia and urea) is too high, so that it cannot compete with Chili nitrate.

Direct Synthetic Process. This will probably be most extensively followed. In the various methods employed (HABER-BOSCH in Germany, CLAUDE in France, CASALE in Italy and that of the General Chemical Company in America) the same fundamental reaction is used, but they differ as regards pressure, origin and methods of purification. At present the 14 factories of the world (others are under construction) have an output of 320,000 tons, of which 50 % is produced in Germany.

The quantity of energy required and of nitrogen produced is shown in the following table :

Electric arc	68,000	7.3
Cyanamide	15,000	28.2
Synthetic ammonia :		
Electrolytic hydrogen	20,000	2.0
Hydrogen from water gas	4,000	62.5

As will be seen from the above, the energy required by the cyanamide process is about 22 % of that for the electric arc process and that with the water gas process only 6 %. The present tendency in fixing atmospheric nitrogen is to require less and less electric energy and to change what began as an electro-chemical industry into a chemical industry.

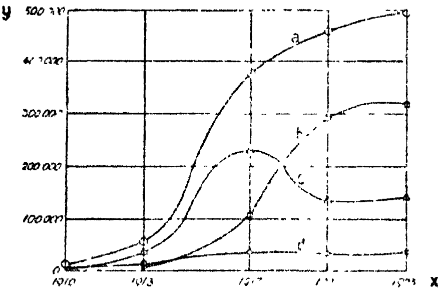

FIG. 92. — Development of the nitrogen fixation industry. (Ordinates show world production of nitrogen, in tons), *x.* = years; *a* = total fixed nitrogen; *b* = fixed nitrogen as ammonia; *c* = fixed nitrogen as cyanamide; *d* = nitrogen fixed by the electric arc.

The products of the synthetic processes also require further modification. Besides sulphate, which is already well known, the following products should be mentioned :—

Phosphate of ammonia. It contains 14.7 % of ammonia and 61.7 % of phosphoric anhydride, is very stable, non-hygroscopic, and has been used with good results. The manufacture depends on the production of phosphoric acid ; at a low cost it is probable that this compound will be more used in future.

Nitrate and nitrate-sulphate of ammonia. The first is excellent but too hygroscopic, hence methods of avoiding this disadvantage are being examined, especially those for the manufacturing of a granulated and oiled product. The latter is much used in Germany.

Ammonium chloride. The development of the synthetic process, especially as connected with the manufacture of SOLVAY soda, is opening up new possibilities for the production of this satisfactory fertiliser at a low cost.

Urea. This is perhaps the most interesting product of the fixation processes. It contains 46.6 % of nitrogen, corresponding to 55.6 % of ammonia, has good physical properties and has given excellent results in practice. The most promising method of production is that of the direct combination of ammonia and carbonic anhydride at a comparatively high temperature and pressure.

Nitrates of calcium and soda. The former gives good results, but has the disadvantage of being hygroscopic and of containing only 13 % of nitrogen. To the production of the second, the principal obstacle is the high cost of soda, the neutralising agent,.

The present tendency, is to obtain fertilisers in which the nitrogen is as concentrated as possible and to combine therewith other fertilising substances, such as potassium and phosphorus. A. F.

276. A Comparison of Atmospheric-Nitrogen Fertilizers.

ALLISON, R. V. (Rothamsted Experiment Station). *Soil Science,* Vol. Vol XVIII, No. 5, pp. 330-352, 1 fig. bibl. Baltimore, Md., 1924.

The atmospheric-nitrogen fertiliser industry has spread greatly especially after the war, in consequence of which a practical comparative investigation as to the efficacy of these fertilisers as compared with the nitrogen fertilisers which have been in use for some time (nitrate of soda and sulphate of ammonia), has become necessary. The author's tests lasted 3 years and were made especially with cotton, maize and tobacco.

Nitrate of ammonia. This gave results quite equal to those of the substances with which it was compared in the tests. It is readily available and has no abnormal effects The greatest objection to its use is the facility with which it absorbs moisture, rendering it sometimes unusable for fertiliser mixtures. This drawback can be obviated by preparing it in a granulated form and oiling, or converting it into double or mixed salts.

Double salt of nitrate and sulphate of ammonia. This produces the same effect as the single salts ; the fertiliser is less hygroscopic than the nitrate salt of ammonia.

Double salts obtained from nitrate of ammonia with chloride or sulphate of potassium. The above remarks also apply to this fertiliser.

Phosphate and superphosphate of ammonia. These are excellent sources of nitrogen, promote growth and give a satisfactory yield. The large amount of phosphorus partially masks the effect of the nitrogen.

Ammonium chloride. This is readily available, but in some cases when applied in quantities of 40-60 lb. per acre, has had a toxic effect, probably due to an excess of chloride ion.

Urea. Similar in its effects to the other substances and has the advantage of being physically an excellent substance, which, in addition, leaves no basic or acid residues. It seems therefore to be the ideal nitrogen fertiliser.

Urephos. Gives varying results ; it has been used only to a limited extent and no definite conclusions can be drawn.

Cyanamid. Gave less satisfactory results than the other fertilisers, mostly because too many factors, both in the soil and the fertilising mixtures, influence its decomposition. Results are poor when applied together with acid phosphates, this being probably due to the transformation of a part of the cyanamid nitrogen into dicyanamid, a compound which not only cannot be utilised as a source of nitrogen, but which is decidedly toxic to some plants and to nitrifying bacteria.

If applied separately from the phosphates, it gives good results, especially when phosphate of lime or basic slag are used as a source of phosphorus.

Cyanamid gives different results with different crops, being satisfactory for maize, and not so for cotton, probably because the latter requires nitrogen as a nitrate, whereas maize can utilise it also as ammonia. With the winter cereals, especially wheat and rye, results are in all respects similar to those obtained with the check fertilisers. A. F.

277. **Decomposition of Calcium Cyanamide during Storage.**

JACOB K. D., KRASE, H J. and BRAHAM J M (Fixed Nitrogen Research Laboratory, Washington). Industrial and Engineering Chemistry, Vol 18, No. 7, pp. 684-697, figs 2, bibliography. Washington, D. C., 1924.

Calcium cyanamide when exposed to the air absorbs moisture and carbonic anhydride and it consequently follows that the nitrogen, which is originally present to a great extent as cyanamidic nitrogen, undergoes a partial transformation. The importance of this decomposition depends on storage coditions, such as : temperature, moisture, length of the period of storage, whether in bags or heaps and the hydration of the calcium cyanamide itself.

The authors have studied the nature and extent of the decomposition, under various conditions of preservation, of small and large quantities and for periods of time up to 2 ½ years.

When the calcium cyanamide is exposed, in quantities of a few kg., to unusual conditions of moisture and temperature for long periods the cyanamidic nitrogen becomes totally changed into other forms, especially dicyanamide and urea, to the extent of 70-75 and 20-22 % respectively of the total nitrogen. In this case, 7-8 % of the total nitrogen is lost as ammonia. These are considered as laboratory tests, made in conditions which rarely or perhaps never exist in practice.

The cyanamide which has undergone no treatment decomposes more rapidly than that which has been hydrated or oiled. The calcium cyanamide subjected to such treatments and stored in bags of 45 kg. for a period of 6 months, in normal conditions of temperature and moisture, undergoes only slight decomposition. And the latter is negligible when the calcium cyanamide is kept in heaps, with but a small surface exposed to the air, as in silos, and the decomposition is then limited to a depth of 20 cm. from the top. A. F.

278. Chemical and Biological Studies on Calcium Cyanamid.

JACOB, K. D., ALLISON, F. E, and BRAHAM, J. M (Fixed Nitrogen Research Laboratory). *Journal of Agricultural Research*, Vol XVIII, No. 1, pp. 37-69, figs. 12, bibl. Washington, D. C, 1924.

The nitrogen utilised by plants may come from ammonia or from organic forms ; but most plants utilise that of the nitrates, so that it is necessary to find in what form the nitrogen of the soil exists in order to known if it can, or cannot, be utilised. This investigation was undertaken in order to ascertain the progress of the process of the formation from calcium cyanamid of ammonia and the oxidation of the latter in the soil. The formation from calcium cyanamid of urea and ammonia is rapid : after 5-10 days there is no more cyanamid. The urea also is quickly transformed into ammonia, which does not accumulate in the soil. The other substances produced by the decomposition of the cyanamid, probably dicyanodiamid, remain, on the contrary, for a long time in the soil.

The nitrification of the cyanamid is slower than that of the urea and ammonium sulphate, and the more abundant the application, the slower the nitrification. After the initial delay of 2-4 weeks, nitrification proceeds in the usual way. Some of the products of the decomposition of the cyanamid, however, are toxic to the nitrifying bacteria, and, if in considerable quantities, cause accumulation of ammonia.

Hydrated or oiled cyanamid has the same effect as the other ; the slight advantage of the oiled over the hydrated is due to the fact that the latter contains dicyanodiamid.

Nitrification reaches its maximum with moisture at 10 %, and is nil at 40 %. The most favourable temperature is 38.5 C. Partial sterilisation of the soil with phenol stops nitrification.

The dicyanodiamid, added slowly, disappears to the extent of one half in 2 months ; the nitrogen which accumulated in the soil as ammonia is not quickly nitrified. With 12.72 mg. of dicyanodiamid per 250 gms. of soil, 36 weeks are necessary for the nitrification of the nitrogen added, whereas with more abundant applications there is no nitrification after 40 weeks.

The nitrification of sulphate of ammonia is prevented when there is 10 5 mg of dicyanodiamid per 100 gms of soil present ; $^1/_{10}$ mg. per 100 gms. of soil is sufficient to greatly retard nitrification. The ammonification of urea, on the other hand, is not affected by the dicyanodiamid, even at a concentration of 315 mg. per 250 gms of soil.

Sulphate of guanilurea decomposes rather slowly into ammonia, which is then nitrified. The addition of urea delays the process of nitrification.

Salts of guanidina (nitrate and carbonate) reduce nitrification for some weeks, and the more so the more abundant the application. Nitrate of biguanid is practically inert ; the slight depressions of nitrification observed are due to errors is the test. A. F.

279. Some Effects of Sulphur on Crop and Soils.

ADAMS H. R. (Purdue Agricultural Station). *Soil Science*, Vol. XVIII, No. 2, pp. 111-115. Baltimore, Md., 1924.

Soil acidity and the quantity of soluble matter increases with the quantity of sulphur applied and the length of the incubation periods. There is a certain relation between the P_H values and the quantity of soluble matter present, which fact becomes more evident in crops on sand. The increase of soluble salts is undoubtedly due to a great extent to the biological oxidation of the sulphur.

When a certain hydrogen-ion concentration has been reached, the slightest change of acidity is sufficient to bring about definite effects on the plant. Thus in sand there is a good growth at P_H 4.3, but practically none at P_H 4.1. In the case of fine sand with silt, these results are realised at P_H 3.5 and 3.4 respectively. The difference between the two soils show that the degree of acidity at which a plant grows, is related not only to the plant itself, but varies with the soil.

As regards leaching, it is observed that it practically carries away the sulphates, but not the acidity caused by the oxidation of the sulphur. On the contrary, leaching renders the soils slightly more acid.

There is also a certain relation between the P_H values and the total quantity of lime necessary for neutralising the soil under various conditions.

A. F.

280. Influence of Sulphur Oxidation on Solubility of Soil Minerale.

STEPHENSON, R. E. andPOWERS W. L. (Oregon Agricultural Experiment Station). *Soil Science*, Vol. XVIII, No 4, pp. 317-321. Baltimore, Md., 1924.

In the semi arid zone of Oregon, sulphur gives excellent results as a fertiliser, especially it used for legumes, in quantities of 50 lb. per acre per year. The reasons for its influence are not clearly known; it may serve as a direct plant nutrient, or bacterial activity may be stimulated, or the nutriment for the plants may be held in solution.

The authors have found that owing to the oxidation of the sulphur into sulphates, there is an increase of lime and potassium soluble in water, but a decrease of phosphorus soluble in water. These results are obtained both in dry and moist soils.

It should however be borne in mind that even small applications of sulphur cause an increase of acidity, and that consequently the continued use of sulphur in even slightly acid soils may finally become injurious through the acidity, unless the latter is neutralised by the use of lime.

In certain conditions, the flocculating effect of the oxidised sulphur may be of considerable value, especially in the case of heavy soils and those in which flocculation is necessary in order to carry off the accumulation of alkali. In this respect sulphur acts in the same way as chalk.

A. F.

281. Chemical Fertilisers in Austria since the War.

Gesetz vom 21. April 1918, betreffend die Gewinnung phosphorsäurehaltiger als Düngemittel verwendbarer Stoffe. *Reichsgesetzblatt* No. 161, 3 pages. Vienna, 1918.

WILLNER (Dr. Ministerialrat im Bundesministerium für Land- und Forstwirtschaft). Die Höhlenwirtschaft. *Gemeinverständliche höhlenkundliche Vorträge.* Herausgegeben von der Bundeshöhlenkommission. Part 7, 16 pages, Vienna, 1020.

Idem. Die Gewinnung von Höhlendünger in Österreich. *Berichte der staatlichen Höhlenkommission* Year I, Part 1, 2, 9 pages, Vienna 1920.

Berichte der staatlichen Höhlenkommission, Year I.

GÖTZINGER, Entstehung und Ausfüllungsprodukte der Höhlen. *Gemeinverständliche höhlenkundliche Vorträge.* Part 3, 17 pages, 6 ill. Vienna, 1922.

SCHADLER (gewesener Betriebsleiter der staatlichen Höhlendüngerwerke). Chemisch-geologische Beobachtungen gelegentlich des Abbaues der Phosphatablagerungen in der Drachenhöhle bei Mixnitz. *Berichte der staatlichen Höhlenkommission.* Parts 1, 2, Year III, 3 pages, 9 tables. Vienna, 1922.

Bundeshöhlenkommission im Bundesministerium für Land- und Forstwirtschaft. Der Höhlendünger und seine Verwendung. 11 pages. Vienna, 1923.

KYRLE (Universitätsprofessor), Theoretische Speläologie, 353 pages, 187 illus. and 10 tables. Wien, 1923.

SCHADLER, D Josef (gewesener Betriebsleiter der staatlichen Höhlendüngerwerke). Die Phosphatablagerungen in der Lettenmanyerhöhle bei Kremsmünster in Oberösterreich. 6 pages, 4 illus. and 1 table. Parts 1, 2, Year I. Vienna, 1020. *Berichte der staatlichen Höhlenkommission.*

REITMAIR (chemisch landwirtschaftliche Versuchsstation in Wien). Der Höhlendünger als Ersatzdüngemittel für Thomasmehl und andere Phosphate. *Oekonom,* 1. November 1920, Part 22, 3 pages. Vienna.

Idem. Ergebnisse von Höhlendüngerversuchen. *Berichte der staatlichen Höhlenkommission.* Parts 1, 2 Year II, 3 pages. Vienna, 1921.

ABEL. Berichte über die Ausgrabungsarbeiten in der Drachenhöhle bei Mixnitz in Steiermark. *Berichte der staatlichen Höhlenkommission.* Parts 3, 4, Year I, 5 pages. Vienna, 1920.

SCHADLER, Die Phosphatgewinnung aus der Drachenhöhle bei Mixnitz in Steiermark. *Berichte der staatlichen Höhlenkommission.* Parts 1, 2, Year 6, pages, 1 table. Wien, 1921.

Statistische Übersichten über den auswärtigen Handel Österreichs für das II. Halbjahr 1919 . . . . . für das Jahr 1920 und die folgenden. Vienna, 1920 and following years.

KALLBRUNNER. Measures Adopted in Austria for the Encouragement of Agriculture during the War (1914-1918). *International Review of Agricultural Economics,* Year XII, Nos. 11, 12, 35 pages. Rome, 1921.

Idem. Pflanzenernährung, Düngung und Düngerstätten, 88 pages, 9 illus. Vienna, 1924.

NEUBAUER Hans, Die Mährstoffentnahme der Keimpflanzen, und ihre Anwendung auf die Bestimmung des Nährstoffgehaltes des Bodens. *Zeitschrift für Pflanzenernährung und Düngung*, Part 5. Leipzig, 1923.

One of the main causes of the decline in agricultural production during the war was the impossibility of importing the raw materials for the manufacture of artificial fertilisers.

The importation of such fertilising substances was even more pressing a necessity than in peace time, as in consequence of the reduction of the live stock there was much less stable manure available, and the fertilising value of what was available was less, as no concentrated feeds could be given to the animals and a great part of the straw and hay had to be given up to the military authorities.

The small quantities of chemical fertiliser which were available were State controlled, that is to say requisitioned, handled at and distributed from a Central Office. There was only a very small quantity of basic slag and bonemeal, as raw phosphates for the superphosphates were not available, only potash salts and some sulphate of ammonia. The quantities of this fertilising constituent on hand in the gasworks and coke factories were requisitioned for munitions.

The defeat of the Central Powers and the establishment of the Austrian Republic made conditions even worse. Czechoslovakia kept for itself the small quantities of basic slag which were produced at the time, and the large coke factories were also in that country. Only very small quantities of sulphate of ammonia could be manufactured by the Vienna gas-works on account of the small supplies of coal. In addition, the finances of Austria were so unsound that it was impossible to consider any large importation of artificial fertiliser constituents. In consequence a variety of expedients were adopted. Of these one of the most interesting consisted in the exploitation of the phosphate containing remains of various prehistoric animals, which had inhabited the caves of neighbouring mountain ranges.

In the course of the year there was a marked increase in the utilisation of raw fertiliser materials in Austria, which was partly due to steady work on the part of the agricultural co-operative warehousing societies and partly also to the great effort that was made to increase the productivity of the soil by supplying it with the required constituents. The resulting increase in consumption was naturally not uniform but varied in the case of each raw material.

The facts in regard to the different materials will be examined in the following paragraphs :

The imports of basic slag into the territory of the Austrian Republic were :

1919 two half-years	11 118	quintals
1920 for the year	2 617	»
1921 » » »	23 726	»
1922 » » »	85 556	»
1923 » » »	328 370	»

Of this last amount 92 643 quintals came from Germany and 82 812 from France. There is no production of basic slag in Austria. In 1920 the supply of this universally employed material was peculiarly scant. In the following years there was a noticeable diminution in the content and solubility of the phosphate, which fell to 14 % and less. It is suggested that other processes of manufacture were at the time in use.

The imports of superphosphates and raw phosphates were :

1920	119 894 quintals
1921	44 927 »
1922	16 260 »
1923	157 401 »

Of the quantity imported in 1923, 83 313 quintals came from Czechoslovakia, 47 116 from Italy, and 11 400 from Holland.

In 1922 superphosphate was also manufactured by the 'Phospha' Company, a general agricultural trading company, which had established factories in the former munition works at Blumau. Returns from this manufacture were however unsatisfactory on account of the competition of the cheaper foreign production and it was consequently abandoned.

As a consequence the manufacture of *Reformphosphat* was undertaken by the firm of the same name in 1922. The process consists in treating finely ground, mineral phosphate with sulphuric acid, with the result that a part of the lime constituents of the phosphate is converted into gypsum, which when the fertiliser is spread on the fields absorbs water, increases in volume and thereby breaks up the soil-particles, making the soil porous and easier for the roots to penetrate The phosphate does not however become water soluble

In consequence, the action of the *Reformphosphat* is much slower and only takes effect on damp soils, remaining ineffective on dry soils. The action on meadowland is, owing to its acidity, not so satisfactory as that of the basic slag which contains quick lime and has a strong alkaline reaction, after which clover nearly always establishes itself where the grass has disappeared. This is not the case when *Reformphosphat* is applied, and consequently it is not in demand, and no extension of the sale of this product is to be looked for.

Raw phosphates are scarcely utilised at all in Austria.

Rhenaniaphosphate which is manufactured from artificially prepared slags was imported in small quantities first in 1924, after a consignment had been tested in 1923 in Vorarlberg. It is generally considered as equivalent to basic slag, although it is superior to it on account of its potash content which though small adds to its value.

Towards the end of the war some natural caves were discovered in which there were found considerable masses of material containing phosphates. These were exploited by miners in the years immediately after the War, and the material brought down by wire rope lines into the valleys and loaded on to the railways. At first the small caves near Peggau in South Styria were worked, afterwards the large Drachenhöle near Mixnitz.

This cave lies about 600 metres above the level of the valley and is connected with the railway station by a wire rope line 2700 metres long. The cave itself is almost horizontal and is 600 metres long with an entrance 50 metres wide and 18 metres high. It is piled with heaps of remains of different prehistoric animals, especially cave-bears, and deer, which clearly used to find a retreat in the recesses of the cave where they could give birth to their young, pass the winter and die. The remains in part consist of bones which are in a good state of preservation and when made the subject of scientific investigations provide much interesting information in regard to the life and habits of these long extinct animals. No fewer than 15 truckloads of bones were examined and, with the exception of such material as had scientific value, were converted into bonemeal and mixed with the cave excreta to form manure. Among the bones were the pelvic bones of three female animals still containing the skeletons of young cave-bears, which had perished with their mother at the moment of birth.

These remains mingled with earth, presumably resulting from the splitting and crumbling of the rocks throughout the cave, and with excremental remains form a reddish clayey mass which contains about 30 % water and varying quantities of hardly soluble phosphates. Layers with 8 % alternate with layers with 16 % of phosphate and layers of moderately soluble alternate with those of almost insoluble phosphates. Some layers contain very small quantities of nitrogen, but in most cases the nitrogen must have been gradually washed away.

The exploitation was first undertaken by the State and afterwards by a *Höhlendung Bau- und Betriebs-Gesellschaft*, in which the State had shares. The sale of this fertiliser was arranged by the Department for Chemical Fertilisers of the Bureau of Agriculture. About 800 truck loads were utilised, representing the remains of approximately 40 000 cave-bears.

It may be mentioned, that in the cave some 350 metres from the entrance, there is a spring of water close to which, to judge from finds of ashes, bones and tools, there were early human settlements, ascribed to Palaeolithic times.

By a law of 21 April 1918 (*Reichsgesetzblatt* 161) the State has reserved proprietary rights in all caves, but no further exploitation of other caves was undertaken, as the profits to be obtained could not compete with the valuable and comparatively low-priced artificial fertilisers.

The State however exercises its supreme right over the caves and continues the scientific examination of the remains. In connection with some interesting investigations of the caves, various materials were dug out and removed, and as chemical analysis revealed a certain content in phosphates, the material was spread on the neighbouring pastureland, and formed a topdressing.

The cave manure never achieved any great popularity on account of the small content in soluble phosphate and the high water-content.

The use of bonemeal as manure is not of much importance in Austria. Only a small proportion of the available bones are made into colloid free bonemeal, partly in the form of ' Idealphosphates ' which are obtained by treatment with sulphuric acid. The imports of bonemeal and bone ash amounted in 1921 to 117 metric quintals, the export to 34 206.

Chilean saltpetre which is much prized especially by beet-growers, began to be imported in 1920, a quite inconsiderable quantity of 8 518 quintals being first imported which gradually increased till in 1923 the import reached 15 767 quimtals. In 1924 consignments of the synthetic product known as 'German saltpetre' came in, this fertiliser having the same characteristics as Chilean saltpetre.

The imports of *sulphate of ammonia* were always small and in 1923 amounted to 10 300 quintals only. In 1924 there was an increase importtation of this fertiliser especially of the German artificial type.

Simultaneously a remarkable exportation of sulphate of ammonia took place, amounting in 923 to 6 718 quintals.

There is also a large output of sulphate of ammonia from the gas-works of Austria. The production in 1923 is estimated as 30 000 quintals. In the early post-war years the production was necessarily less, as only small quantities of coal were available for working.

Leunasallpetre, which is a mixture of saltpetre and ammoniacal nitrogen was brought to Austria first in 1924, an embargo on the export from Germany having been in force up to the spring of that year. This very valuable artificial manure which contains 9 % saltpetre and 18 % of ammoniacal nitrogen has become very popular already on account of its effect which is both rapid and lasting and it should become the nitrogenous fertiliser of the future.

The still more valuable urates have hitherto been imported into Austria in small quantities only.

Calcium nitrate of which 23 582 quintals were imported in 1923 is not yet in favour and only relatively few farmers realize its proper value. It is the cheapest of the nitrogenous manures and can be satisfactorily used by mixing it with basic slag or potash salts before spreading. There is no home manufacture of calcium nitrate.

The utilisation in Austria of *bloodmeal, horn scrapings* etc. is negligible.

Potash salts were imported as early as the second half of 1919 to an amount of 39 078 quintals There was a gradual increase until in 1921 imports reached 224 157 quintals, but from that year onwards there was a decrease, and in 1923 only 186 739 quintals were imported. This decline is to be attributed to the fact that in the first years after the War many kinds of salts with a low potash percentage were introduced, whereas at the present time a product with an exceptionally high percentage (40 %) of potash salts is being imported.

In 1924 a limited quantity of potash salts was imported into Austria from France.

Only a very small proportion of the 4 035 quintals imported of *wood ash* can be used as potash fertiliser. This import is balanced by an export of 13 278 quintals.

Of calcareous fertilisers only small quantities of *quick lime* and a somewhat larger amount of *refuse lime*, that is sweepings and dust from blast ovens, come on the market. The latter is gritty and is full of lime burnt too hard and is seldom of much use. A modern product is *Calcinit* which consists of a mixture of 25 parts of ground quick lime and 75 parts of ground carbonate of lime, and is very effective, particularly on account of the fineness with which it is ground.

Marl and gypsum are scarcely in use at all.

In some towns the collected excreta mixed with peat or with street sweepings and ashes are used as a fertiliser. Naturally this manure is often of small value, because the admixtures tend to reduce the content and because the lime of the street sweepings volatilises the ammonia of the excreta. By reason of the slight efficacy of certain mixtures this fertiliser is now somewhat discredited.

The co-operative warehousing societies and their federations do important work at the present time in the distribution of chemical fertilisers.

Mention may be made of an attempt by the Austrian Government in 1921, while control was still at least nominally exercised, to bring all grain under State control. In order to induce farmers to hand over the largest possible quantity of grain, if possible in excess of the prescribed contingent (the so-called excess contingent) the distribution of fertilisers on the most favourable terms was proposed, but unfortunately the anticipated success did not follow. Many farmers had no confidence in these fertilisers and the distribution was carried out quite mechanically. Various circumstances arose which somewhat detracted from the value of the policy. To mention one curious feature, the distribution in any district was arranged according to an alphabetical list of the farmers: those whose names began with *A* to *I* received kainite, those beginning with *K* to *N*, basic slag, and all the rest sulphate of ammonia.

The NEUBAUER experiments for determining the soil content in nutritive material assimilable by plants are receiving much attention in Austria. The Experiment Stations are completing these tests, and it is said that the NEUBAUER laboratories are shortly to be re-established.

If it should be found possible to determine with precision and in a short time what amount of nutritive material is available in each soil, the knowledge of the proper and successful application of artificial fertiliser will be extended, resulting in an increase in the use of chemical fertilisers and therefore in the productivity of the land. H. K.

Agricultural Botany, Chemistry and Physiology of Plants.

282. Relations between the Agricultural Value of Meadow Grasses and their Anatomical Structure.

SCHINDLER H. Untersuchungen über den Zusammenhang zwischen dem landwirtschaftlichen Wert der Wiesengräser und ihrem anatomischen Bau. *Zeitschrift für das landwirtschaftlichen Versuchswese in Deutschösterreich*, 1 vol. 8vo., pp. 76, tables 11. Vienna, 1923.

The author investigated the microscopical structure of meadow grasses in order to find an explanation of their varying agricultural value. It was found that the morphological and anatomical characteristics (size and subdivision of the vascular bundles, structure of the leaf epidermis and also the indentation of the edges) can furnish the clue to the differences in the value of such grasses as cattle feeds.

On these characteristics he bases a system of classification of grasses whether good or bad, and examines the question as to why the number of " noble " grasses has been reduced, and then studies the estimation of the value of the grasses also from the chemical and biological point of view, in connection with the digestion of cellulose.

It was found that the cell walls of grasses can be digested in the stomach of herbivorous animals when the cell walls are not lignified or cutinised. In judging the value of a meadow grass therefore, it is essential to examine the development of the vascular bundles and the thickening of the cuticle. A. F.

283. Root Thermotropism.

TREITEL O. Thermotropismus bei Wurzeln. *Botanisches Archiv*, Vol. VII, Parts 5-6. Königsberg, 1924.

According to WORTMANN, thermotropism is the curving in of roots under the influence of a lowering of temperature when placed in moist sawdust. HOOKER recently showed that at an equal fall of temperature, if the roots are immersed in agar, the deformation does not take place, though in this medium their growth and characteristic reaction continue unaltered. This different behaviour at the same temperature was attributed by HOOKER to the different degree of moisture, who considers that it is a question not of thermotropism but of hydrotropism.

On this point however the question is still undecided.

The author then gives the results of his own experiments, in which he was careful to eliminate as far as possible the influence of moisture. In these conditions it was observed that the mere loss of water by the roots could only be followed by their positive curvature. It cannot be stated with certainty however that the degree of moisture in the immediate vicinity of the roots was uniform. It may well be that in consequence of the transpiration of the roots themselves, the aerial region nearest to the warmest part of their surface had a greater degree of moisture, thus allowing the roots to react. This hypothesis suggested the idea of covering the roots with waterproof substance, such as paraffin, vaseline, olive oil, lanoline, etc. Of these, olive oil proved to be the most suitable.

The roots, covered with a light coating of olive oil, when subjected to a reduction of temperature underwent no deformation, apart from a slight positive curvature.

A similar result was obtained by using collodion instead of olive oil. The author thereupon, concludes that the negative curvature obtained by COLLANDER'S and SIERP'S tests could not be of a thermotropical nature. It remains doubtful whether the facts observed should be attributed to negative hydrotropism which may be decided by further tests, since up to the present only positive hydrotropical curvature of the roots has been observed.

On continuing to lower the temperature only positive curvatures were observed ; these also continue if the roots are covered with a coating of collodion. Since the influence of moisture alone is sufficient to cause in the same period of time similar curvatures of the roots to those observed on merely lowering the temperature, it may be concluded that the thermotropical phenomena have, at least partially, some relation with the different degree of moisture.

It may also be that the warmer part of the roots withers, and this also seems confirmed by the fact that during the curving, root growth is stopped. G. B.

284. The Absorption of Carbon by the Roots of Plants.

BREAZEALE, J. F. *Journal of Agric. Research*, Vol. XXVI, No 7, pp. 303-311. Washington, D. C., 1924.

The author has carried out many experiments with wheat seedlings in culture solutions and has found that the presence of nitrates in the solution is followed by the presence of carbonates in the ash of the plant.

The absorption of any element of plant food is probably dependent upon the state of equilibrium of both the plant sap and the nutrient solution; this equilibrium may be acid, alkaline, or neutral, and will probably be different for each plant.

The following conclusions were reached:

The presence of sodium or ammonium nitrate, or calcium, sodium or potassium carbonate in culture solutions for wheat seedlings, is followed by the presence of carbonates in the ash of the plants. When sodium nitrate is present in solution the NO_3 ion seems to be absorbed first, leaving in solution some sodium which combines with the water and with the CO_2, to form sodium carbonate or bicarbonate. This in turn gives up CO_3 to the plant. The plant absorbs CO_3 by means of its roots, probably as an ion, or exhudes CO_2 to maintain equilibrium in its tissues or in the nutrient solution.

Wheat plants do not seem to be able to absorb CO_2 from solution in water without the presence of a soluble base. The absorption of a basic radical seems to depend largely upon the absorption of an acid radical. The term " lime-affinity " as applied to plants, might perhaps more properly be stated as " carbonate-affinity ". W. S. G.

285. The Blooming of Wheat Flowers.

LEIGHTY, C. E., and SANDO, W. J *Journal of Agricultural Research*, Vol. XXVII, No. 5. pp. 231-244. Washington, 1924.

The time and manner of the blooming of wheat flowers is the result of the interaction of internal and external factors. When the flowers have reached the blooming stage, the exact time and rate of their opening is determined by meteorological conditions. The chief object of the present investigations is to procure additional information as to the influence of external factors on the blooming of wheat.

For this purpose, the plants examined were grown in a garden at Washington, and belonged to *Triticum vulgare*. More than 400 flowers in 7 ears on 4 plants which began to bloom at about the same time, were examined, and additional observations were also made on field grown plants and on plants raised in the green-house of the Arlington Experiment Station, Rossyln, Va.

The authors show by means of a diagram the various flowers of the spikelets of each ear, and note the time of blooming. As soon as each flower opened the empty extruded anthers were removed to facilitate observation and prevent confusion in recording the data. It was considered that a flower had bloomed as soon as a perceptible separation took place between the lemma and the palea.

The blooming process of the flowers. – Under favourable conditions the wheat flower begins to bloom by opening the glumes, at first slowly, then more quickly until the extremities of the palea and lemma are generally separated by a distance of 3-4 mm. After the opening of the glumes, the anthers are pushed up by the filaments, which lengthen, and when quite extruded they assume a pendent position. While these phenomena are taking place the anthers dehisce apically along the line uniting the two cylinders. In a certain number of flowers however it was observed that the anthers were completely extruded and pendent before they commenced to open.

In such flowers it was observed that one, two or three anthers, often situated in the folds of the palea, remained held between the glumes. Other flowers showed anthers partially protuding and imprisoned in the tips of the glumes. The greatest length of filament observed was 10 mm., exclusive of the anther which was 3 mm. long. In one case a filament was observed to attain its full length of 10 mm. in 10 minutes. ASKENASY has measured numerous wheat and rye-flower filaments and states that in most cases the fibres grow from 1 to 1 ½ mm. per minute. Immediately after complete extrusion, the pollen, aided by the inversion of the anthers is completely expelled from the pollen-sacs. About a third of it usually falls inside its own flower, causing a plentiful pollination of the stigma; the remaining pollen is scattered around and may fall on the stigmas of other flowers. Cross pollination is apparently effected in this way, especially if the anthers of the neighbouring flowers have been removed, as shown by LEIGHTY and HUTSCHESON, or have aborted. If conditions are unfavourable for the opening of the glumes, the anthers of the wheat flower shed their pollen and fertilise without extrusion, or they may only protrude outside the tip of the glumes. About 5 % of the flowers (19 in a total of 406) recorded in this investigation, behaved in this way. Each of the ears under examination has one or more such cleistogamous flowers, and the maximum number observed in one flower was six. All these flowers yielded grain. Under certain conditions dependent on environment, wheat flowers may be completely cleistogamous.

Time required. — The process of the blooming of wheat flowers is variable. Some open in less than a minute, others require 3 minutes or more. As regards the time which elapses between the beginning of blooming and that in which the anthers attain the pendent position owing to their complete extrusion, observations have been made of 25 flowers at various times of the day favorable to blooming. The time required for the anthers to assume the pendulous position varied in these 25 flowers from 1 minute 40 seconds to 5 minutes 25 seconds, with an average of 3 minutes 36 seconds. The time required depends on the position of the ear during the period of protrusion of the anthers, on the resistence offered by the glumes, on the movement of the air, temperature, rain and humidity It was found that the time between the opening and closing of the glume. of a flower varies from 11 to 66 minutes. Frequent difficulties were mes with in determining the exact time at which the glumes are completelyt closed owing to the presence of some anthers or filaments in their midst lodging between the glumes. The average duration is 26.5 minutes.

Time of blooming. — The blooming of flowers was observed at various times during the day and night. By " day " is meant the whole period of 24 hours, by " daylight ", the period between the rising and setting of the sun, by " twilight ", the combined periods of about 1 ⅓ hours each before the rising and after the setting of the sun ; " night " is the remaining portion of the " day ", without other designation. Of 406 flowers observed, 350 opened in daylight, 28 in twilight, and 28 during the night, the proportion therefore being as follows : 82.6 % in daylight, 6.9 % in twilight and 6.9 % during the night. From the fact that the greater number of the flowers observed bloomed in daylight, it should not be concluded that light is indispensable to flowering, for wheat flowers placed in a dark room reached full bloom, and in the same manner as flowers under natural conditions. The influence on flowering of the duration of the period of daylight or of the changes in the duration of this period was not determined. Other investigations have shown that many varieties of wheat flower and mature in a shorter time after planting when subjected to a long period of daylight, than those exposed to a shorter period. The authors have also studied the order in which the flowers bloom in the ears and in the separate spikelets, the interval elapsing between the blooming of the 1st and 2nd flowers (which varies from a minimum of 1 hour 16 minutes to a maximum of 15 h. 43 m.) and the number of flowers which bloomed at various times during the 6 days (from the 14th to the 19th May) when the observations were made. The results of this last investigation are summarised in the following table:

Hour in the forenoon	
2.01 to 3	7
3.01 » 4	17
4.01 » 5	7
5.01 » 6	5
6.01 » 7	8
7.01 » 8	15
8.01 » 9	29
9.01 » 10	33
10.01 » 11	31
11.01 » 12	32
Total blooming in the forenoon	184

In the afternoon

12.01 to 1	17
1.01 » 2	21
2.01 » 3	41
3 01 » 4	27
4.01 » 5	30
5.01 » 6	42
6.01 » 7	13
7.01 » 8	4
8 01 » 9	7
9.01 » 10	5
10.01 » 1.55 a m	15
Total during the afternoon	222
Add: » » » forenoon	184
Total number of flowers observed	406

The authors then investigate the influence of meteorological conditions on blooming, and by means of a graph show the relations between temperature, rain, light at various hours of the day, and the blooming of the flowers. Three periods of intense flowering were noted: the first on the 14th May between 5 and 6 p. m.; the second on the 15th May between 9 and 10 a. m., 1-2 p. m. and 3-4 p. m.; and the third on the 16th May between 9 and 10 a. m., 1-3 p., m. 5-6 p. m. On the 17th and 18th May there was great irregularity in flowering owing to unfavourable atmospheric conditions (cloudiness, rain, changes in temperature).

The lowest temperature noted during this test was 55° F., and the highest, 78°F.; blooming commenced at a temperature of 56°F.

On 6 ears, 383 flowers were studied, and of these, 307 yielded grain, *i. e.* 80.2 %, but it is interesting to observe the variations of this percentage as related to the position of the various flowers in the ear. Thus the proportion of the flowers setting seed, which occupy the lowest place in the ear was 96.6 %, that of those in the highest position was 21.4 %. The flowers of one ear could not be calculated owing to damage by the birds.

The following additional tests were also made: (1) The flowers of wheat ears completely immersed in water until fully matured apparently bloom in the same manner as those of normal ears, except as regards the filaments of the stamens, which do not lengthen, and the anthers which do not open; the flowers under these circumstances remain open for several days. (2) Some plants were placed in a dark room at a temperature of 60°-70°F. for a week at flowering time. The flowers reached full bloom under these conditions in about the same space of time as do those under normal conditions. The flowers blooming in the dark had their glumes as widely separated as those blooming in the light. (3) In a greenhouse at a temperature of 55°-56° F. flowers with their glumes separated by a distance of 3 mm. were observed; the movement of the anthers was easily discernible at this temperature. When the temperature was gradually lowered the lengthening of the fibres was retarded, and at a temperature below 55°.F no further movement was perceptible and the anthers apparently remained stationary, but the pollen was discharged at a temperature as low as 52°F.

The maximum temperature at which the flowers were observed to bloom in the greenhouse was 80°F. F. C.

286. On the Cessation of the Assimilation of Potash by Rye Seedlings growing in a disproportionately Small Volume of Soil.

ESCHENHAGEN, M. Ueber den Verlauf der Kaliaufnahme junger Roggenpflanzen, die in einem unverhältnismässig kleinen Bodenvolumen gewachsen sind. *Botanisches Archiv*, Vol. VII, parts 5-6. Königsberg, 1924.

The author investigates the progress of the assimilation of nutritive substances by seedlings cultivated in abnormal conditions, and compares the yields obtained.

The author's investigations include 5 series of tests made under various growth conditions.

The results may be summarised as follows : the yield of dry matter, considered as a function of the increasing potash fertilisation, follows the law of the influence of growth factors ; in accordance with the said law, the influence of potash is constant. The assimilation of potash however, like the potash content of the soil, is determined not only by this last factor, but also by the sum of the influence of the other growth factors.

As to the influence of these last it was found that light is only of subordinate importance, while a mean temperature of 11.3°C. has a favourable influence. An important condition for the maximum assimilation of potash was found to be the uniform concentration of the solution. If a nutritive substance in an easily soluble form is placed at the disposal of the plant, it is found to be quickly assimilated by the plant, independently of its growth The chemical factors of growth are of no importance except when their presence has a direct influence on the assimilation of potash.

In conclusion it must be admitted that the assimilation process of rye plants is not a function depending on the quantity of potash placed at their disposal, but is mainly dependent on the degree of concentration of the solution used. It may therefore be doubted whether the value of a soil can be estimated solely by estimating the quantity of nutritive substances it contains.

From a practical point of view, the method of investigation based on the influence of external factors on plant growth, is perhaps the only one which may lead to the establishment of a practical system of fertilising in order to obtain the maximum yield of a crop. G. B.

287. The Influence of Sodium Chloride on the Growth of Alfalfa.

LOMANITZ S. (New Jersey Agricultural Experiment Station). *Soil Science*, Vol. XVIII, No 5, pp. 353-368, 1 fig. 1 plate, bibl. Baltimore, Md., 1924.

Report of experiments in growing alfalfa in water cultures containing sodium chloride, in varying quantities of from 0.0 to 0.6 osmotic atmospheric pressure; SHIVE solution (at 1.75 osmotic atmospheric pressure) was used as a control. The tests lasted 77 days.

An increase in yield was obtained in 5 out of the 6 cultures, this increase mostly applying to the aerial parts. The absorption curve of the water followed that of the yield. The proportion of root growth to that of aerial part is greater when the total yield is less, and vice versa.

The variations of the nitrogen percentage in the whole plant are not such as to indicate definitely that there is any relation between this factor and the others. The roots of the sulphur chloride cultures contained a larger percentage of nitrogen than those of the control.

The absorption of sodium chloride by the plants varies in direct proportion to the quantity available. The roots however contain less than the aerial part. A. F.

288. Influence of Moisture and Insolation on the Lupin (*Lupinus augustifolius* L.) and on the Alkaloids in its Seeds.

MALAVSKI, H. and SYPNIEWSKI, J Wplyw wilgotnosci gleby i naswietlilenia na rozwoj lubinu (*Lupinus augustifolius* L.) i na zwastosc alkaloidow w jego nasienu *Pamietnik Panstwowego Instytutu Naukowego Gospodorstwa Wiejskiego w Pulawach* (Memoirs of the Polish National Institute of Rural Economy at Pulawy), Vol. 4, Part A, pp. 302-327, resumé in French. Cracow, 1923 (received January, 1925).

In taking up this investigation, the authors proposed to find a means of diminishing the bitter alkaloid content of lupins. The influence of nitrogen fertilisers being of no practical importance, in view of the capacity of the lupin to assimilate the free nitrogen in the air, the authors studied only the influence of physical agents, such as solar radiation and moisture. A pure growth of *Lupinus augustifolius* L. was cultivated in pots in ordinary soil, without any fertiliser, and a group of pots was exposed to diffused light in a roofless tent covered in on the east, west and south; the water given and that evaporated was measured The control pots were untreated in the open and some had no plants. The moisture was kept constant in each group of pots and varied in quantity from 60 to 20 % of the power of absorption of the soil.

The following results were obtained from these tests:

(1) The lupins cultivated in diffused light flowered and matured first;

(2) the last to do so were those with moisture maintained at 20 %;

(3) evaporation increased up to a maximum which coincided with flowering, and then decreased;

(4) the moister the soil, the more water is lost by evaporation;

(5) the height of the plant, the thickness of its stems and the number and length of the pods increase with soil moisture;

(6) the plants reared in diffused light are smaller;

(7) the weight of the plant, the number and weight of the pods, the weight of 100 seeds, of the stem and of all parts above the ground increases with the moisture;

(8) the plants raised in the shade weigh less in all their parts;

(9) *soil moisture and insolation influence the alkaloid content of the seeds.*

In comparison with the parent seeds used for this experiment, those which were produced from them contained:

(*a*) with a 20 % degree of moisture: 50 % more alkaloids than the parent seeds;

(*b*) with a 35 to 50 % degree of moisture: the alkaloid content was less than that of the parent seeds;

(*c*) with a hygrometric degree of 65 % the quantity was the same as for group (*a*).

As regards insolation, the seeds of a plant reared in the shade contained more alkaloids (nearly double) than those of a plant cultivated in the same conditions as regards moisture under normal insolation.

The dry matter of the parent seeds contained an average of 0.68 % of alkaloids, the seeds produced under normal insolation 0.35 %, and those cultivated in the shade 0.82 %.

The seeds of plants reared in diffused light contained 2.5 times more alkaloids than those reared under normal insolation.

As regards the influence of moisture it may be concluded that the divergences, increase or decrease, from the most favourable conditions of soil moisture may determine an increase in the alkaloid content of the seeds.

The results obtained by the authors as regards the influence of insolation are therefore contrary to those obtained by A. GORIS and H. DELUARD in the case of belladonna, according to whom the leaves of these plants contain more alkaloids when reared in the sun than when grown in the shade. In this case however the author considers that the contradiction is only apparent. The alkaloids, like other nitrogenous chemical compounds, form in the leaf, and afterwards, passing into the seed, participate in the synthesis of the albumen. The function of the alkaloids in this synthesis, is not fully understood but the authors are of opinion that if this synthesis takes place in the conditions most favourable to the growth of the plant, the quantity of alkaloids of this transitory or accessory product should be less. All divergencies from the most favourable conditions, either towards a decrease or increase of moisture or insolation, may produce a difference in the alkaloid content of the seeds.

G. Z.

289. Effects of Moist and Dry Air on the Rate of Respiration and Breakdown of Ripe Pears.

LUTHRA CHAUD, J. (Punjab Agricultural Service, India). *The New Phytologist*, Vol. XXIII, No. 3, pp. 131-142, plates 6. London, 1924.

The investigation of the causes of the spoiling of fruit is of the utmost importance in the finding of satisfactory methods of preservation, especially for pears, which are liable to spoil quickly. Bearing in mind the close relations between respiration, transpiration and physiological changes, the importance of the moisture or dryness of the air will be readily understood.

The author has observed that in dry air the rate of respiration and transpiration is increased. The great loss in weight is accompanied by shrivelling, and early spoiling. In moist air, on the other hand, the pears retain their healthy yellowish-green colour and keep much better.

The intensity of respiration is lowered as soon as the pear begins to show signs of break down.

The specific weight of the juice is always greater in the external than in the internal parts, both as regards pears kept in moist, and those kept in dry air. On the spoiling of the pear, the specific weight of the juice throughout increases

Hexose sugars were found in the juice. A comparison between the depression of the freezing point observed and that corresponding based on the quantity of hexose sugar, shows a constant difference, which indicates that acids and salts are also present in the juice.

A. F.

290. On Starches as a Food Reserve.

ZIEGENSPECK, H. Ueber Sparstärke. *Botanisches Archiv*, Vol VII, Parts 3, 4, pp. 251-273. Königsberg, 1924

The author's investigations tend to show that the substances known under the collective name of starches, from the point of view of plant physiology should be divided into nutritive starches and starches having the character of a food reserve.

G. B.

291. Isolation of a Protein from the Leaves of the Alfalfa Plant.

CHIBNALL, A. C. & NOLAN, L. S. (Connecticut Agric Exper Station, New Haven) *The Journal of Biological Chemistry*, Vol LXII, No 1, pp 173-178. Baltimore Md., 1924.

The authors have isolated from the leaves of the alfalfa plant (*Medicago sativa*) a protein having physical and chemical properties analogous to those of that extracted from the leaves of spinach, especially as regards its sensitiveness to the presence of salts when it is in weak acid solutions.

The said protein of the cytoplasm contains 15.73 % nitrogen and 0.2 % ash. The portion isolated constituted 3.23 % of the solid matter of the leaves.

Of the nitrogen contained therein, 7.49 % is in the form of argenin, 1.79 % histidin and 8.17 % lysin.

A. F.

292. Spinacin, a New Protein from Spinach Leaves.

CHIBNALL, A. C. (Connecticut Agric Exper Station, New Haven). *The Journal of Biological Chemistry*, Vol LXI, No. 2, pp. 303-308 Baltimore, Md., 1924.

The author has isolated from the cytoplasm of spinach leaves, a protein compound in a state of purity such that it shows no reaction by the MOLISCH carbohydrate test. Taking into account the complex nature of the protoplasm and the little that is known as to its chemical composition, the preparation of this product, which apparently, has undergone no hydrolytic modifications, is of considerable importance. It seems that the protein is present in the cytoplasm as an anion, at a hydrogen-ion concentration only a little below the isoelectric point. It is insoluble in water, but soluble in the slightest excess of acid or alkali, and contains 16.25 % of nitrogen.

The quantity of protein isolated is only $^1/_5$ of the total quantity which is said to exist in the cytoplasm.

The author has been able to extract it in quantities of 4.87 % of the total solid matter of the leaves. The protein compound contains 6.65 % of arginin, 2,34 % of histidin and 8.19 % of lysin. A. F.

293. The Chemistry of Grape Pigments.

ANDERSON, R J & NABENHAUER, F P (Biochemical Laboratory, New York Agricultural Experiment Station, Geneva) I. A Contribution to the Chemistry of Grape Pigments II Concerning the Anthocians in Clinton Grapes. *The Journal of Biological Chemistry*, Vol XLI, No. 1, pp 97-107 Baltimore, Md, 1924

One of the authors (ANDERSON) had previously shown that the pigments in two varieties, of American vines (*Vitis aestivalis* and *V. labrusca*) are chemically identical with the Monoglucoside *enine*, already isolated from the *Vitis vinifera*. The pigments of the Clinton grape were now examined. This is the first cultivated variety of the *Vitis riparia*, which seems to contain a substance similar to that found in *V. labrusca*.

The pigment of the variety examined consists mostly of a monoglucoside, antocyanine. The antocyanine chloride, C_{23} H_{25} O_{22} Cl, does not separate into definite crystalline forms, but the picrate, having the formula C_{23} H_{24} C_6H_2 (NO) $_3$OH), crystallises into bright red needle prisms. The glucoside is easily hydrolysed by boiling with dilute hydroclhoric acid and gives a molecule of glucose and antocyanidine chloride, C_{17} H_{15} O_7 Cl, which crystallises in prisms from the warm solution.

The antocyanidine chloride consists mostly of a delphinidine monomethylic ether, also of a certain quantity of dimethylic ether.

The absorption spectra of the antocyanine and antocyanidine chlorides form a wide band which passes from yellow to blue. A. F.

294. The Isolation of the Antiscorbutic Factor

SILVA S. S. (Biochemical Department, Lister Institute, London). The Antiscorbutic Fraction of Lemon Juice *The Biochemical Journal*, Vol. XVIII Nos. 3-4, pp. 632-637 Cambridge, 1924.

Id and CONNELL, S. . B. The Reducing Properties of Antiscorbutic Preparations Do., pp 638-640.

Id Id The Differential Dialysis of the Antiscorbutic Factor *Ibidem*, pp. 641-646, 1 fig

SILVA has isolated in lemon juice a fraction corresponding from 0.3 to 0.7 % of the solids, which contains approximately all the active antiscorbutic element. It has an extremely low nitrogen and phosphorus content and has a reducing reaction in so far as it reduces nitrate of silver and decolorizes permanganate of potash ; these two reactions are the work of two different fractions.

By dialysis experiments, it is shown that the diffusion of the anti-scorbutic factor proceeds in a different manner from that of sugar and of nitrogenous substances contained in decitrated lime juice. The same property of diffusion is possessed by the juice of the Swede turnip.

The antiscorbutic factor is diffused through colloid membranes of lower permeability than those which allow the passage of methylene blue, neutral red and safranin. The size of the molecules of the antiscorbutic factor is probably not very different from that of the hexose sugar.

F. A.

Plant Breeding and Seeds.

295. Heteromorphism and the Law of Triple Convergence.

TIKEL, R. L'étéromorphisme et la loi de triple convergence. *Bulletin de la Société botanique de France*, Vol 61, No. 5, pp 510-523 Paris, 1924

It is a well known fact that there are many kinds of plants in which the forms of the leaves show remarkable variations in the same individuals. GOEBEL has given the name of heteroblasts to these species which are generally known as heteromorphs. NANDIN speaks of bi-form species and DIELS of heteromorphism, to describe in general terms the varying forms which appear at a given period (according to age) determined by the growth stage, and makes a distinction between young and transitory forms (*Folgenformen*). The author considers the question of heteromorphism, both in seeds and roots and arrives at the conclusion that there exists a law which he calls the law of triple convergemce, whereby in heteromorphous woody plants, the leaf of the seedling, the leaf of the auxiblasts (DODE) and the leaf of the rizoblasts converge to form a uniform type G B.

296. The Genetic Relation between *Triticum dicoccum dicoccoides* and Similar Morphological Types.

LOVE, H. H (Cornell University Agricultural Experiment Station) and CRAIG T W (Office of Cereal Investigation, Department of Agriculture). *Journal of Agricultural Research*, Vol XXVIII, No 6, pp. 515-519, 8 plates. Washington, 1924.

The authors state that it is possible to produce *Triticum dicoccum dicoccoides* as a cross between Early Red Chief, a variety of *Triticum vulgare*, and the variety Marouani of *Triticum durum* Desf.

In this paper it is shown, by analysis of the generations, that different varieties, such as occur in nature, may be produced by experimental breeding with the synthetic form.

G B.

297. On Hybrids from Wheat and *Aegilops*.

LEWICKI, S. and DUTKIEWICZOWNA, B. O mieszancach pszenicy z *Aegilops*. *Pamietnik Panstwowego Instituto Naukowego Gospodarstwa Wiejskiego w Pulawach* (Memoirs of the Polish National Institute of Rural Economy at Pulawy). Vol. 4, Part A. Cracow, 1923 (Received January, 1925).

Aegilops is not included in the usual genealogy of wheat. Basing on the ordinary indices of relationship, however, and the morphological structure and crossing capacity of the hybrids, there is a species of wheat, *Triticum monococcum*, which shows more differences from the other species of the same kind than exist between it and *Aegilops*. The *monococcum* indeed is distinguished from the other species by its morphology, the quantity of its chromosomes, resistence to certain diseases and serological reaction, and only produces hybrids with other species of *Triticum* with great difficulty.

The question then arose whether there was not a certain affinity between *Triticum monococcum* and *Aegilops ovata*. The authors fertilised the latter with mature pollen of *T. monococcum* and obtained 5 normally developed hybrid seeds, which produced 5 plants. These plants developed ears after 77 days and flowered after 85 days Flowering continued for a long period and followed a pathological course, as the glumes were open for some days in certain spikelets and the stamens contained very little pollen, and that but slightly developed, and which did not fertilise a single flower on more than 30 ears Furthermore, the plants had all the characters of *Aegilops* and did not resemble any species of wheat The result of observations seem to indicate that *Aegilops ovata*, as a generically anterior form, may have taken part in the development of forms of the *Triticum* genus, without it being however possible to assign a place to it in their genealogy.

Basing on these data, the authors consider that . (1) There are no genetic grounds for incorporating the *ovata* species in a distinct genus of *Aegilops* ; (2) neither are there any grounds for denying the relationship of the *ovata* form with wheat.

G. Z.

298. Inheritance of Pubescence of the Nodes in the Crosses of two Varieties of Wheat.

LOVE, H II (Cornell University Agricultural Experiment Station. CRAIG, W. T (Office of Cereal Investigations, Department of Agriculture). *Journal of Agricultural Research* Vol XXVIIII, No 8, pp 841-844 Washington, 1924.

Nearly all varieties of wheat have glabrous nodes but there are some which have pubescent (velvet) nodes. The authors make a study of the behaviour of this factor in a variety with pubescent nodes crossing it with others with glabrous nodes and noting the behaviour of the dominant factors in respect to the pubescence of the glumes. G. B.

299. Number of Chromosomes in Maize.

LONGLEY, A. E. (Office of Biophysical Investigations, Department of Agriculture). *Journal of Agricultural Research*, Vol XXVIII, No. 7, pp. 673-681, plates 3, bibliography Washington, 1924.

One of the lines of enquiry of modern genetics consists in the investigation of the number of chromosomes in the hybrids. The author applies this method to the study of the chromosomes in maize and in different genera of the tribe Tripsaceae.

According to KUWADA, maize (Zea) is a tetraploid species derived from an ancestral type having six as the basic chromosome number. The author however concludes that ten is the basic chromosome number for *Zea mays* and its relatives.

The author accepts in general the conclusions drawn from the recent cytological studies in Rosa, Rubus, Oenothera, Datura, Triticum, Avena and Hyacinthus, made by modern investigators, which seem to indicate that in the polymorphic genera the more primitive and more stable species have a smaller chromosome number than more recent or hybrid forms. G B.

300. Germination Capacity of the Pollen of certain kinds of Apples and Pears.

KOBEL, F (Schweiz. Versuchsanstalt in Wadenswil) Die Keimfähigkeit des Pollens einiger wichtiger Apfel- und Birnsorten und die Frage der gegenseitigen Befruchtungsfahigkeit dieser Sorten *Landwirtschaftliches Jahrbuch der Schweiz* Year 38, part 4, pp. 461-473, bibl Berne, 1924

The author states that the question of the reciprocal fertilisation of certain varieties of apples and pears is being studied in connection with the germination capacity of the pollen, which varies from one kind to another. It is however not enough to count the number of the pollen grains which arrive at maturity, but also necessary to take into account the length and shape of the pollen tube Fruit-growers should accordingly note these conditions so as to ensure adequate fertilisation in their orchards. G. B

301. Effect of High Temperatures on Germination and Growth of Maize.

KEINHOLZ, R. (Professor of Botany, University of the Philippines), *Philippines Journal of Science*, Vol. 25, No. 3, pp. 311-346, tables 21, figs 4, bibliography, Manila, 1924.

There has been a considerable increase in the use of heat in the disinfection of cereals within recent years, and experiments are seldom made to ascertain the effect of treatment on germination. Maize is much more sensitive to heat than wheat and barley.

The author's investigations enabled the following conclusions to be drawn:

Air-dry maize, containing 10-11 % moisture is killed by exposure to 80° and 90° C. for 25 and 10 minutes respectively, and is injured by exposure to 70°, 80°, and 90° C. for 80, 10 and 5 minutes.

The resistance to high temperatures varies inversely as the water content.

Under air-dry conditions diseased maize contains most moisture and disease-free least moisture.

Desiccation brings about changes which cause diseased maize to become very resistant to heat. The nature of these changes is unknown.

The resistance to heat of air-dry maize differs with the variations in climatic conditions.

The amount of growth of seedlings follows, in general, the percentage of germination of the treated and untreated maize. The percentage of germination, green weight and height of plants of heated maize grown in soil, parallel the behaviour shown in germination tests. In air-dry maize, disease-free seed is always highest and diseased lowest. In desiccated seed, diseased is highest and disease-free usually lowest. W. S. G.

302. The Disinfection of Cotton Seed with Carbon Disulphide.

FERREIRA, E. *Gaceta Algodonera*, Year I, No 9, pp 21-25 Buenos Aires, 1924

The author after describing the properties of carbon disulphide, says that it possesses excellent antiseptic and antifermentative powers, and has toxic qualities against animal parasites, hence, apart from the care necessary in the use of carbon disulphide, it is the most suitable chemical substance to employ against insects which attack grain and seeds.

The disulphide should be used on dry seeds.

With regard to dosage, the Royal Decree of 2nd June suggests 400 gm. per m³ for a period of 24 hours. George SMITH advises only 138 gm. per m³, the period however not extending beyond 24 h. Particulars of the treatment appear in "Distintos métodos para la destrucción de los insectos" (Various methods for the destruction of insects), a leaflet published by the Ministry of Agriculture in 1914. Against "albroca" (*Gasterocercodes gossypii*) in vetch seed, BRUNNER recommends 500 gm. of disulphide under the same conditions, without any *danger of its affecting germination*. Professor HABERLANDT employs a dose of 1 kg. per m³ to disinfect cereals attacked by Calandra and Tinea. VERMOREL for the same treatment of wheat advises a dose of 1 kg. per m³. The author gives a long list of various doses used by other authors; in North America the dose is usually 260 gm. per m³ for 40 hours; if however the operation lasts only 24 hours, the quantity is increased to 434 gm. The author has used 400 gm. for 24 hours, obtaining results which enable the following conclusions to be drawn: the carbon disulphide treatment does not in the least injure the germinative capacity of the seed; it exercises an antifermentative action on weak seed. Disinfection should be carried out shortly before the sowing of the seed (this being done in August, the mean temperature of which favours the expansion of the carbon sulphide gases); the seed to be disinfected should be quite dry and mature.

The author found a germinative capacity of 68-77 % after separating the weak seeds. A cleaned sample from the last crop was analysed and the germination test gave 48 % of green seed which did not ripen, hence, it was assumed that the sample was a very inferior quality of seed. In order to avoid such seed some characteristics are given which growers might bear in mind, so as to make it unnecessary to carry out the germination test. The following should be rejected: the smallest seeds, with the husk or episperm depressed or dented, sometimes of a yellowish-white colour, yielding to pressure or detaching itself more or less easily when pressed by the nail, and seeds in a more or less developed state. For this purpose three small heaps of 100 seeds each are formed. In each of these heaps, the hard seeds, resisting pressure, are separated from the small, atrophied, weak and useless seeds. Separate additions are made of the respective quantities and the average of good and bad seed is thus obtained. From these data the quantity of seed which should be sown per hectare is then calculated, the germinative capacity being also taken into account.

E. M. F.

CROPS IN TEMPERATE AND TROPICAL COUNTRIES.

Cereals, Roots and Forage Crops.

303. The Tolerance of Wheat for Soil Alkalis.

NEIDIG, R. E. and MAGNUSON, H. P. *Soil Science*, Vol. XVIII, No 6, p. 449-67, diagrams 3, tables 8 Baltimore, 1924.

The authors base their observations on the recoverable rather than the added salts. As regards carbonate of soda, it is shown that wheat is not affected by sodium carbonate until 0.1 per cent. recoverable was found. At 0.2 per cent. concentration there was evident toxicity, 0.5 per cent. recoverable salt always resulted in a total crop failure.

Sodium chloride when present alone in the soil is not harmful until 0.2 per cent. recoverable salt concentration is reached; 0.25 per cent. recoverable sodium chloride showed a decided toxicity.

With sulphate of soda their was no detrimental effect until a concentration of 0.75 per cent. was reached.

These results are found with the first crop. In the second crop there is on the other hand a stimulating effect, except in the case of treatment with the highest quantity of carbonates.

A. F.

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304. Superior Varieties of Maize Cultivated in S. Paulo.

LOBBE, H. (Campo de Sementes de S. Paulo). Das melhores variedades de milho cultivadas en S. Paulo. *Revista da Sociedade rural brasileira*, Year V, No. 52, pp. 309-322, 8 plates. S. Paulo, 1924.

In the opinion of the author, maize will be the crop of most value in America on account of its high yield, the ease with which it is cultivated, and its adaptability to different climatic conditions.

As regards the varieties to be chosen for cultivation, he remarks that the two varieties of North-American origin, " Golden Dent " and " Hickory King " appear to be the result of a good selection, the cobs being of excellent quality and all plants up to standard, but on the other hand they are very liable to mildew and in addition require particular kinds of seasons for really successful cultivation.

The *quarentão* of Argentine origin is an excellent variety ripening early, giving two crops in the year and also is popular with the settlers.

The varieties best adapted to the country and most to be recommended are Catteto, Crystal and Assis Brazil, their distinguishing characteristics being richness in protein, starch and oil These varieties have been definitely adopted for cultivation on a large scale and are distributed from the Experiment Station of São Simão. A. F

305. The Importance of Maize Cultivation in Guatemala.

JACKSON C. *Revista Económica*, Year XL, No. 7, pp 370-371. San Salvador, 1924.

Maize is the oldest and the chief crop in Guatemala, and is the almost exclusive food of four-fifths of the population. The yield, according to official returns, is 3 million metric quintals. The author however considers this much below the actual figure, attributing the error to false harvest declarations, and he therefore forms an estimate based on the consumption by the population, by livestock and in industries. Estimating the consumption by the inhabitants at 7,300,000 quintals, that by livestock and for other purposes at 1,700,000 quintals, making a total of 9 millions as the approximate annual production, the value of the annual yield, in Guatemala, at an average price of 2 dollars per quintal would be 18 million dollars.

The author then compares the maize yield with that of coffee (at present the most important export) which is estimated at 10 million dollars ; with the sugar-cane, which hardly reaches 5 millions ; and with the plane-tree and livestock production ; and concludes that though all these productions are very important, none is so important as maize for Guatemala, it being also borne in mind that maize is a national source of wealth, while the others are in foreign hands. He considers that all the industries which utilise maize as raw material should be encouraged, in addition to the export trade.

E. M. F.

306. Investigation on the Vistula Horse-Bean.

KARNOWSKI L. Studia nad bobikiem (*Vicia Faba* L., *V. minor* Al.) Cz I Bobik nadwislandski, *Pamietnik Panstwowego Instytutu Naukowego Gospodarstwa Wiejskieog w Pulawach* (Memoirs of the Polish National Institute of Rural Economy at Pulawy), Vol. 4, Part A Cracow, 1923 (recived January, 1925).

The following is a resumé of the results of three years' investigations by the author on a variety of horse-bean common in the Vistula region.

The so-called Vistula horse-bean belongs to the *Vicia Faba* L. var. *minor subras. equina Al.* variety ; some of its sub-varieties resemble the *columbina Keke*

The seeds are greyish-fawn in colour. Crossings with the variety having violet seeds and with those having green seeds, yielded in the F_2 generation 25 % of fawn coloured seed, 50 % of pale violet or. in the second case, of slightly marked greenish seed, and 25 % of dark violet in the first case, with as many green seeds in the second. The author concludes that the violet or green colour depends on one factor only.

The hilum is black, grey or light grey, there being 25 to 50 % of plants with a black hilum. In the crossings, 25 % of plants with a black homozygous hilum were obtained.

The form of the seeds may be : (1) a more or less oval spheroid, (2) oblong with blunt ends, (3) oval and flattened at the sides. To distinguish the form of the seeds the following form-index has been adopted : $(L_1 + L_2) . L_3$, where L_1 is the length, L_2 the breadth and L_3 the thickness of the seeds ; this index is preferable to the correlation of the three dimensions coefficient.

The weight of 100 seeds is 15 % higher in moist years than in dry seasons , the average weight is 55.70 gms. ; variability fluctuates from 14 to 34 %. The length of the stem is 98 cm., with an 11 % coefficient of variability. Length of stem up to the first pod is an important character in selection ; there is a negative correlation between this character and the number of pods ; the corresponding coefficient varies from −1.200 to −0.900. The tendency to form lateral stems only appears if the plant finds all the conditions sufficient for the development of the main stem, or under abnormal conditions ; lateral stems rarely produce mature seeds, but are not unfavourable either to the total weight of the yield or to that of 100 seeds.

The number of pods varies from a minimum of 27 to a maximum of 47 % and is in correlation with the length of the stems and their number.

It has been found that 10 % of the flowers undergo extraneous pollination. Crossing with *Faba major* are easily effected. In the F_1 generation intermediary types were obtained, in F_2, side by side with the paternal types, a whole series of intermediary forms appeared, which proves that these varieties differ from one another in a large number of characters, the study of which has not yet been completed.

G Z.

[306]

307. Experiments in Acclimatising Scotch Potatoes in Austria.

HAUNALTER Emil, Member of the Council of the Federal Institute for Plant Cultivation and Seed Testing in Vienna. *Oesterreichische Zeitschrift für Kartoffelbau,* Part 1, p. 30, 31 March, 1924. (Appendix p. 31).

In 1921 Austria was almost entirely without seed potatoes, and a delivery of 6000 loads of Scotch potatoes was made by England in the form of a loan for production, thereby making the cultivation of potatoes once more possible in Austria. It was also expected that by this means a regeneration on a large scale of Austrian potato cultivation might be effected. While the original object of the re-establishment of potato production was successfully achieved, the latter attempt ended in failure. The imported kinds included Up to Date, King George, Edzel Blue, Arran Comrade, Arran Victory, etc., and with the exception of Up to Date which had been grown in Austria for ten years past, degenerated so completely that scarcely any seed potatoes of these varieties were obtainable. An official enquiry showed that they had for the most part lost their productivity, a proof of the fact that in the case of potatoes, any considerable changes in the conditions under which they are grown are followed by deterioration in their yielding capacity. The Up to Date variety is still grown. H. K.

Fibre Crops.

308. The Outlook for Flax Fibre and Linseed.

I. The Outlook for Flax. *South African Journal of Industries,* Vol. VII, VII, No. 7, pp. 473-475. Pretoria, 1924.

II. Linseed Selection Experiments in India. *Nature,* Vol. 113, No. 2850, p. 472. London, 1924.

III. Flaxseed Production, *North Dakota Agricultural College, Bulletin* 178, pp. 43, tables 19. North Dakota, U. S. A., 1924.

IV. Acreage of Linseed in U. S. A. *Journal of Department of Agriculture,* Irish Free State, Vol. XXIV, No. 1, p. 72. Dublin, 1924.

The shortage of cotton supplies and consequent high prices have given a stimulus to the linen industry, as to-day flax fibre is the cheaper raw material. The imports of flax and tow into Belfast this year show a great advance over those of 1922-23, but are still far below the amount imported in 1913. In pre-war days Russia exported 300,000 tons of fibre, whereas now the total is probably not more than 20,000 tons. In 1920 Canada's fibre area reached 31,300 acres, but owing to low prices, has decreased; prices have now improved and the area is increasing. In 1922 Kenya exported 2000 tons, which amount could be greatly exceeded (1).

Flax at £100 per ton is a remunerative crop and the market price is not likely to be lower for some years.

In India the crop is grown for the supply of soil seeds and work has been carried out in the hybridisation and selection of plants from Indian strains, some of which have given promising increases in yield of seed.

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(1) See *R.* 1924, No. 63. (*Ed.*)

In the United States flax is chiefly grown for linseed oil production, and North Dakota yields about one-half of the total output. The two chief problems have been wilt (*Fusarium lini*) and weeds. Varieties resistant to wilt have been developed and are now available, e. g., N.D.R. 114 and N.D.R. 52, of which the former is highly wilt resistant. Weed growth is lessened by sowing flax in rotation after a crop giving a clean cultivation. Mixed crops of flax and wheat are grown to some extent as the practice encourages early seeding, controls weed growth and is easy to harvest. The linseed crop for 1923 in the United States was estimated at 19,400,000 bushels, an increase of 66 % over that of 1922, but is still 50 % below the requirements of the country. W. S. G.

309. Cotton in Brazil and the International Conference at Rio Janeiro, 1922.

I. *Annals da Conferencia Internacional Algodoeira*, Rio de Janeiro, 1922.

Vol. I. O Algodão do Brasil a Conferencia Mundial Algodoeira de Nova Orleans, pp 293-312 (Deoclecio de Campos).

Vol. II. O Interesse da Industria Allemã no Algodão Paulista, pp. 323-334 (Oscar G Mors), A Industria Algodoeira em São Paulo, pp. 335-345, (Octavio Pipo Nogueira), Necessade da Especificação Algodoeira nas zonas Culturaes da Parahyba, pp. 273-393 (Getulio A. Cesar), O Rio Grande do Norte Algodoeiro, pp 413-439 (Antideo Guerra).

II *Brazilian Cotton*, pp 211-212. Arno S. Pearse, Manchester, 1922.

III. *Cotton in North Brazil*, p 147, Arno S Pearse, Manchester, 1922.

IV. *Extrait du Rapport de M. le Prof.* G. Rossati sur la Conference Cotonnière Mondiale de la Nouvelle-Orléans. Institut International d'Agriculture, 1919-1920.

V. *Classes and Committees of the World Cotton Conference*, New Orleans 1919 (Instructions for the use of Delegates to the Conference)

VI. *The Cotton Growing Countries*, p 13, Brazil International Institute of Agriculture, Rome, 1922.

Cotton in Brazil, Rio Janeiro Conference. — Many are the cotton growing countries, present and potential ; some are very active and important, some have possibilities, but have not yet shown any very conspicuous results. Brazil occupies a high position on the active list, in regard to quantity of output, and at the same time holds out the promise of great future development.

After a journey through most of the cotton growing districts of Brazil, Mr. Arno Pearse, the Manchester Cotton Expert, in an address at Rio Janeiro, in August 1921, made the following statement :

" The area suitable for cotton cultivation in Brazil is larger than that in the United States, and the conditions of climate and soil are probably more favourable to cotton cultivation than in any other part of the world ".

This is another way of saying that in the possibilities of the extension of its cotton growing, Brazil has no serious competitor. The United States already produce about two-thirds of the world's cotton, but inherent circumstances forbid any considerable further extension of area. Thus, with climate and soil alike favourable in large tracts of country, the future belongs to those who guide the destinies of Brazil.

International cotton conferences have been latterly frequent, and have varied in interest and importance according to the selection of suitable locality. Some of the more recent meetings have been dignified by the title of " World's Cotton Conference " as at New Orleans in 1919 and at Manchester and Liverpool in 1921. From the very fact of their respective sorroundings, these World Conterences differed greatly in their outlook ; the first was held at the gateway of the North American cotton belt, where the preponderant interests were those of growers, ginners and exporters, the other conferences took place far from cotton fields, in the great Lancashire cities where the cotton bale is among the most familiar of objects, but where very few of the inhabitants could recognize a cotton plant if they saw it.

The British Conferences were concerned almost entirely with the manufacturers' point of view, with trade questions, with the standards as a basis of contract, with matters of finance Growers and exporters from many parts of the world were present, but the cotton traders of Lancashire predominated in number and in influence

Cotton questions took on quite another complexion at the Congress held in the splendid City of Rio Janeiro amid sorroundings of the greatest interest to European visitors, and, even more important, on shores where cotton has long been the prime factor in one of the chief industries Here, under the southern tropic, the North American cotton man and the Lancashire spinner were equally strangers and the atmosphere was completely changed.

The International Cotton Conference of Rio Janeiro was held in October 1922, under the auspices of the Government as represented by the President of Brazil in person, and by the Ministers of Agriculture and of Foreign Affairs ; it was carried through by Conference members well qualified to guide opinion.

Among the subjects proposed for discussion were included :

(1) A general Review of cotton growing in Brazil and in other countries ;

(2) Costs incurred and prices obtained, also measures for aiding the industry ;

(3) Means for improving Brazilian cotton growing,

(4) The cotton of north eastern Brazil ;

(5) Improvements in handling picked cotton and the by-products ;

(6) Intensification of cotton growing ; proposal for Federal Government support ,

(7) Classification and formation of standards of cotton, and types of by-products ;

(8) Spinning, weaving, domestic consumption ; exports of cotton goods ,

(9) Financial credits ;

(10 Exporting cotton and by-products, shipping, charges, rates of freight.

The broad bases of the World Conferences at New Orleans and Liverpool have been briefly indicated and in the statement submitted at Rio by M. Deoclecio de Campos (Annals, Vol. I, p. 293) material is given for an interesting contrast between the New Orleans and the Brazilian Congresses.

M. De Campos has quoted details of the New Orleans programme and conclusions ; the subjects were as follows :

(*A*) World requirements of cotton ; increased consumption demands increased production ; stabilization of prices ;

(*B*) Production, selection, of seed, methods of cultivation and of picking ;

(*C*) Ginning, uniform baling and compression ;

(*D*) Warehousing and damage before shipment ;

(*E*) Transportation and insurance ;

(*F*) Buying and selling, equitable tare, net weight ;

(*G*) Exchange, classification, contracts, speculation ;

(*H*) Financing, foreign credits, exports ;

(*I*) Research, reports, and statistics, national and international ;

(*K*) Organization of the Cotton Conference on a permanent basis adapted to all cotton interests.

Here there is a different view from that typified in the Rio programme. New Orleans begins with a world-wide survey of cotton supplies and requirements, a position much less accentuated in Brazil. At Rio there is much to be said on Federal inspection in furtherance of more scientific methods of growing ; in North America the principal inspection discussed refers to classification, and has since resulted in the establishment of Universal Standards for United States Cotton One point of similarity may be noticed, the growers are exclusively interested in their respective crops, hardly at all in those of other countries.

At New Orleans a strong recommendation, addressed to all cotton growing countries, was made in favour of a uniform system of statistics relating to cotton yields, imports and exports, and of improvements in the methods of collecting and transmitting these data, and it was proposed that all data should be communicated immediately to the International Institute of Agriculture in Rome. The Institute has made good use of the facilities recommended, as cotton is one of the principal crops now discussed in the Institute's monthly and quarterly Reviews and in periodical monographs, such as " The Cotton Growing Countries " (Rome 1922).

In order to minimize the loss occasioned by bad weather and exposure the New Orleans Conference insisted strongly on the necessity of sufficient storage in close proximity to ginneries.

There was also much discussion on methods of financing the American cotton crop ; the establishment of credits on uniform bases was recommended for the consideration of bankers and financial agents. M. de Campos dealt very fully with statistical improvements in his statement, giving examples of the methods adopted by the International Institute of Agriculture. The spreading of knowledge concerning agricultural science, and more particularly of scientific cotton growing, cannot fail to be encouraged by the parallel dissemination of exact statistics, embodying the results obtained by improved methods of cultivation.

The safeguarding of the harvested crop is a point of equal importance in North and South America, and in proportion to an increased annual yield in Brazil, the necessity for adequate protection from weather damage becomes more urgent. This question has been included in the statement of M. DE CAMPOS, as indeed have all the material points made at New Orleans. Some few were of merely local interest, and some such as the question of revised classification and Universal Standards have been transformed from recommendations into accepted facts.

At the Rio Conference several members contributed papers on cotton growing in north-eastern Brazil, and furnished many interesting details as to the production of high-class cotton in that region, which is in many respects the most important. Mr. ARNO PEARSE has also made a special study of these plantations in his "*Cotton in North Brazil*". Mr. PEARSE is insistent on the necessity for adequate irrigation in this area under the torrid equatorial sun, and has based his argument on actual observation; he gives an account of what has already been accomplished by the provision of lake reservoirs, as well as what actually remains to be done in the cotton growing districts.

M. Antidio GOMEZ, Delegate from the Cotton Departments of the States of Parahyba and Rio Grande do Norte, furnished much detailed information on the various species grown under his inspection. In the Agreste, or Littoral, in the low-lying lands near the ocean, is found the shorter-stapled *Gossypium herbaceum*, always an annual; further inland, in the Matta Zone, among the first range of hills, the Quebradinho cotton thrives on the drier soils, with varieties of *herbaceum* still persistent in the more moist districts; the Caatinga or Catinguera is a higher zone of country, and here the perennial Quebradinho predominates. Again, at a still higher level, the Sertão is reached, subdivided into the Baixo Sertão of the river valleys and the Alto Sertao of the plateaux. Sertao is also the generic designation of the many varieties of long staple perennial (or tree) cotton grown, including Verdão Inteiro, Quebradinho and the much prized Mocó. Last of all the Seridó is reached, the real home of the best Brazilian Cotton, where *Gossypium Vitifolium* (Mocó) is grown to great advantage on gravelly soil, in the many valleys and on the hill slopes. The staple of Mocó is from 1 $^3/_8$ to 1 $^3/_4$ inches (32 to 45 mm.); this variety of cotton is not infrequently employed for mixing with Egyptian, in manufacturing processes. Seridó and Sertão first grade (primeiras) are picked from July to January. Matta Cotton is picked from September to February. Cotton exporters from this region were the first to classify by staple and grade, selecting "primeiras", "medianas" (seconds) and "refugas" (rejections or waste).

With a view to summarizing in convenient form the information supplied by M. GUERRA, the writer has also made reference to Mr. PEARSE'S account of Brazil and her cotton potentialities (*Cotton in North Brazil* p. 147).

A large number of ginneries (in 1922 396), are to be found in all the cotton growing and cotton exporting districts of North Brazil, the most important being in the upper country of the Seridó, where the perennial cotton is prolific. During the years from 1919 to 1922 nearly all the cotton arriving at the port of Natal (Rio Grande do Norte) was exported coastwise to Rio Janeiro and Santos (Tables by M. GUERRA following his paper above mentioned).

In any consideration of Brazilian cotton-growing, special mention must be made of the Southern or São Paulo crop, which was discussed in some detail by M. OSCAR MORS, and M. OCTAVIO MAGUERA at the Rio Conference.

São Paulo is the largest individual Cotton producer among the States of Brazil, though the aggregate yield of the southern crops including Minas Geraes State is on the average not more than 25 % of the entire production of the country. It differs in quality from the majority of the north-eastern cotton, having been raised originally from American seed, while the staple corresponds with " Upland " as a rule, though it is occasionally somewhat longer. Picking in São Paulo takes place between March and May, in contrast with that in the north-east, which continues from July to March. It is only for a very short time during the year that cotton picking is not in progress in some part of Brazil.

That some considerable advance has been made in cotton growing in Brazil is clearly shown by the following figures :

Yield of ginned cotton (lint) in Brazil.

Years of picking	Thousand pounds
1015-16	134,901
1916-17	134,114
1917-18	164,720
1918-19	161,921
1919-20	183-441
1920-21	189 332
1921-22	200,523
1922-23	264,300
1923-24	275,300
1924-25	289,100

It can hardly be doubted that the Rio Conference of 1922 has had a great influence on Brazilian cotton production. The data for the last three seasons were communicated by the Government on February 20, 1925.

J. H. H.

310. Research in Relation to Cotton Cultivation.

Experiment Station Record, Vol. 50, No. 8, pp. 701-708, Washington, D. C., 1924.

The increasing disposition to look to organised experimentation to solve agricultural problems becomes more and more evident. An example of this is shown in the great work now being carried out in the British Empire to promote cotton production, and the reliance placed on research. The world is threatened with a shortage of this raw material and an attempt is being made to meet the demand.

Since 1900 consumption has increased faster than production. The decrease in Egypt has been ascribed to reduced soil fertility, poor drainage, inadequate fertilizing, pink bollworm and other pests and agrarian disturbances. In the United States the main causes of the decline in yield have been the spread of the boll weevil and labour shortage.

The policy of developing a cotton supply from the British Empire itself has been steadily gaining in favour, and in 1902 the British Cotton Growing Association was formed. The Association was granted a royal charter in 1904; financial assistance was given by a number of local governments and grants made from the Imperial Treasury. Where several years ago grants were made from the Treasury of between £600,000 and £700,000, for the Colonies of Nigeria, Nyasaland, Uganda and the West Indies, in 1921 these were almost all cancelled, chiefly because of increased revenues from cotton growing.

The principal cotton fields are India, the Sudan, Nigeria, Uganda, Nyasaland and the West Indies.

In 1917 the Empire Cotton Growing Committee was appointed to advise the Government as to the best means of developing the growing of cotton. The report of this Committee, given in 1919, recommended the enlargement and strengthening of the agricultural departments in the colonies and the establishment of a central research institute and of a bureau of information. In order to train scientific men in the study of cotton the creation was advised, at British Universities, of readerships in plant physiology, genetics, mycology and entomology and the institution of research scholarships, to be held by graduates.

To establish a permanent body to carry out these recommendations the Empire Cotton Growing Corporation was formed under royal charter in 1921. It includes representatives of the Governments of England, India, South Africa and Australia, of the cotton industry at home and in India, of chambers of commerce, of the British Cotton Growing Association and other bodies interested in cotton. It has an income partly derived from a capital contribution of nearly £1,000,000 made by the Government, and partly from a leavy of 6d. per bale on all raw cotton purchased by spinners in England.

Special reports have been drawn up on the possibilities of development of production in Nigeria, Nyasaland, Tanganyika, Western Australia and Queensland. Assistance of a practical nature has been given to the Sudan Government, and Sir John RUSSELL and Dr. Martin LEAKE visited the Sudan to advise on the organisation and direction of agricultural research in connection with irrigation projects in the Gezira, near Khartoum. It is expected that 100,000 acres will be under cotton in 1925.

Grants are made for scholarships to universities and institutions for research in connection with cotton.

The Imperial Institute in London has, since 1903, been a clearing house for information on cotton, and has published reports and papers on cotton production, and carries out investigational work on cotton fibres and samples of cotton soils.

The field of technology has been given attention to by the British Cotton Industry Research Association, incorporated in 1919, which has research laboratories at the Shirley Institute, Manchester. Studies are made of the botanical, chemical and physical properties of the single cotton fibre, knowledge of which is fundamental to the entire industry. The need is felt of purely scientific work, in order to understand the many problems.

The work has naturally centred, to a large extent, on India, which with an ouput of 4,000,000 bales is second only in production to the United States.

In 1917 the Indian Cotton Committee was appointed, and in 1921 the Indian Central Cotton Committee, which in 1923 became a permanent body. Apart from its more formal duties, the committe is charged with the promotion of all measures which will improve the Indian cotton industry.

A central agricultural research institute has been established on a site given by Indore and supported by annual subsidies from the Central Indian States, as Indore is well situated for cotton investigations.

Taken collectively, the work now in hand probably constitutes one of the largest organised enterprises ever undertaken for a single commodity.

W. S. G.

311. Manuring for Cotton Production.

BLACKSHAW, G. N. (Chief Chemist, Department of Agriculture, Rhodesia). *Rhodesia Agricultural Journal,* Vol. XXI, No. 5, pp. 539-542. Salisbury, Rhodesia, 1924.

Cotton can be grown on many varieties of soil, but the land must not be too rich, or vegetative growth is encouraged at the expense of fruit. Land which will yield more than eight bags of maize per acre is inclined to be too rich for cotton, whereas soils which are incapable of giving six bags in a normal season should generally be given a dressing of fertiliser for cotton.

The following scheme of manuring is suggested:

Sandy soils of good type; 200 lb. of high grade superphosphate per acre.

Sandy soils of poor type: 100 lb. of a complete fertiliser, containing 4 % N, 20 % soluble P_2O_5, 6 % K_2O per acre.

Light sandy loams of good type : 150-100 lb. high grade phosphate.

Light sandy loams of poor type : 75-100 lb. of complete fertiliser, containing 4 % N, 20 % soluble P_2O_5, 6 % K_2O.

Heavier soils : 150 lb. high grade superphosphate per acre.

Farmyard manure hinders ripening of the crop and is not recommended.

W. S. G.

[311]

312. Growing of Pima and Upland Cotton in Arizona.

COOK, O. F. and MARTIN, R. D. *United States Department of Agriculture*, Bulletin No. 1432, pp. 14, figs. 6. Washington, D. C., 1924.

The Bulletin describes the methods used in growing cotton in the Salt River Valley, Arizona, including the selection and preparation of land, planting, thinning, irrigation, cultivation and harvesting of the crop. The information has a general application to the irrigated districts where cotton is grown in New Mexico, Arizona and California. Attention is drawn to the necessity of using the roller type of gin for Pima cotton, although more time is taken and the expense is greater than when a saw gin is employed. W. S. G.

313. Sisal-Hemp on the Gold Coast.

Tropical Life, Vol. XX, No. 12, pp. 180-182, plates 2. London, 1924.

The chief product exported from the West African Gold Cost is cacao, grown mostly in the forest regions. Between the coast and the forest areas is a broad belt of land which is too dry for cacao and has hitherto been neglected.

In 1920 the Government commenced the planting of 1000 acres of this land with sisal (*Agave sisalana*), which was completed in 1922. The plants have grown well and have been free from disease. The rainfall is about 25 inches, and falls generally in tropical showers, and no difficulty is experienced in drying fibre, even in the wet season. A factory has been erected and a light railway laid down. The complete installation, including machinery and houses for Europeans and native staff cost about £35 per acre.

The first cutting took place in July 1924, and the yield from the leaf was 3.5 % of dry, brushed fibre. The planting distance is 7 × 7 feet, nearly 900 plants per acre, and the average yield from first cuttings 15 cwt. per acre.

The total cost per ton of fibre, based on one month's work was £18, but it is expected that these figures will be decreased ; it is estimated that a further cost of £4 per ton for transport to the European markets will be incurred. Shipments of about 40 tons have already been made.

W. S. G.

Other Industrial Crops, chiefly Tropical.

314. The Coconut Palm in Indo-China.

GUILLAUME H. in *Bulletin économique de l'Indochine*, Year XXVII, No. 165, II, 1924, No. 137-194, and No 166, III, 1924, pp. 269-323, with many photographs, plans and maps (forming a special supplement).

This report might be described as an " Introduction to the study of the coconut palm in Indo-China ". A complete account of the various problems which arise in connection with this palm would require several years' work, a whole series of local observations and experiments, a thorough knowledge of the various improvements carried out in neighbouring countries, and their value from the point of view of application to Indo-China.

This report represents a preliminary step towards such a complete study. After describing the cultural conditions demanded by the biological requirements of the coconut palm and its geographical and economic environment, the methods which should in consequence be adopted for increasing and improving its cultivation are suggested. In this connection copious reference is made to the experience gained in other countries. Recommendations are also made as to the administrative measures that should be adopted with the object of initiating and encouraging the development of the cultivation of the coconut palm.

The author then discusses the following questions : the world trade in copra ; the origin and distribution of the coconut palm in Indo-China, which is grown on 28 000 to 30 000 hectares in the country of which 17 000 are in Cochin-China , the cultivation of the coconut palm in relation to the climate and soil of Indo-China ; the varieties of this palm in general and in Indo-China in particular ; the diseases to which it is subject, whether already known in Indo-China or not as yet known, but capable of being introduced ; the sanitary regulations for the palm adopted in Cochin-China, Annam and Cambodia (Ministerial Order of 19 June 1914) ; cultivation of the coconut palm in Indo-China by natives and by Europeans ; crop and yield, composition of the nuts ; manufacture of copra, desiccated coconut and other industries ; manufacture of oil ; use of the coir, shell and milk , various other uses ; cost and value of certain products of the coconut palm in Indo-China · estimates of planting for the native and the European types of cultivation ; conditions necessary for the extension of the cultivation of the coconut palm and the various means whereby it may be encouraged. (Indo-China Corr.)

315. Use of *Caesalpinia Sappan* L. for Tanning.

VIGNOLO LUTATI. La *Caesalpinia Sappan* L. per l'industria della concia. *Annali R. Accademia di Agricoltura di Torino* Vol. LXV pp 10 : Turin, 1922

Id id Sulla concia coi frutti di *Caesalpinia Sappan* L. e sulla morfologia loro e dei Tari *Mercurio, Rassegna mensile illus. di Studi applicati al commercio*, Year III. pp. 11, tables 3. Turin, 1920.

The *Caesalpinia* genus, of the Cesalpiniacea family, has numerous useful species ; some supply woods for carving and dyeing, others yield essential oils, edible fruits and fruits rich in tannin, used in tanning and dyeing (*C. coriaria*, *C. digyna*, *C brevifolia*, *C. Paipae*).

The author has received from Sardinia, where it grows luxuriantly in the University Botanical Gardens at Cagliari, leaves and fruits of *C. Sappan*, hitherto known only from the fact that the wood is used in various work and because a red dye is extracted from it ; the trade name is Sappan or Japan wood, although it also comes from India, Siam, China and Malacca ; but its use for tanning was not known.

The greater part of the pods examined were incombustible ; there is practically no tannin in the seeds, which are few and there is a greater yield of tannic matter from the pods without seeds, weight for weight, than from those with developed seeds.

The pods seem quite smooth, but actually there are unicellular hairs irregularly distributed over them which vary in colour from straw-yellow to orange-red and brown. Similar hairs are found on divi-divi, and algarobillas (the fruits of *Caes. coriaria*, *C. digyna* and *C. brevifolia*). The leaf is compound and has as many as 10-12 pairs of leaflets, obliquely oval and oblong, with pointed apex, 3-5 cm. long and 1.5-2.5 cm. wide.

In the estimation of the tannic material the results were as follows :

	Total extract	Non-tannic	Tannic
Fruit	52.2 %	18.1 %	44.1 %
Leaves.	42.5 %	23.4 %	19.1 %

These data prove that the Sappan fruits are very rich in tannin, almost as rich as those of the divi-divi, and algarobillas. While divi-divi renders leather plaint and durable, it imparts a reddish colour which lowers the value of the leather, in consequence of which other and more expensive tanning materials must be used (nut-gall, mirobolans) and extracts from oak and fir bark, in order to avoid the undesirable colour; only the algarobillas render leather flaccid. Divi-divi on the other hand is free from these defects and has good tanning properties, without colouring the leather. The tannic extract of the Sappans acts like that of the divi-divi and causes the same fundamental reaction.

C. Sappan seems very well adapted to climatic conditions in the south of Sardinia and has proved to be very drought resistant and could therefore be cultivated on the dry chalky hills where certain other plants would not grow. The tree flowers all the year round, but the principal harvest could be gathered in the dry season, when the product could be best prepared rapidly and at the lowest cost

The propagation of such trees in southern Sardinia and other regions under similar climatic conditions would furnish a source of excellent tanning material, which has now to be imported.

The fruits of Sappan and divi-divi are similar : if the pods bear seeds, those of the former contain a larger number (5) than the others (2-4) ; there are other differences in the microscopic structure, viz., in the stomata, their position and the number of unicellular hairs on the valves.

The reactions with concentrated sulphuric acid and lime water enable the sappan to be distinguished from the divi-divi and algarobillas.

In his second work the author gives an account of hide-tanning tests made with sappans. The tests were made on calf-skins with the tannic matter extracted from the pods by the PROCTER method.

Four tests were made :

A — hides tanned with pure sappan
B — » » » sappan and quebracho
C — » » sappan quebracho and chestnut
D — » » » piclata, chrome and sappan.

The results were satisfactory; all the samples had an excellent appearance and were of a clear and uniform colour, and did not contract (especially sample A) or stretch. The author therefore considers that *C. Sappan* should be cultivated in Italy and the Colonies.

Sumach leaves are highly valued for the clarity of their extract; to produce an equal clarity with sappans double the tannic matter content is required.

The author gives a series of photomicrographs, which unfortunately are not very clear, showing distinctive botanical characters such as the varying number of stomata and the unicellular hairs already mentioned.

F. C.

316 Rubber in Indo-China.

P Carton in the *Bulletin économique de l'Indochine*: Year XXVII, No. 167, IV, 1924, pp 349-456, with numerous photographs, plates and maps, published separately).

History. The production of rubber has become one of the most important of Indo-China, as a result of the marked and rapid development of the plantations of *Hevea brasiliensis* in South Indo-China. The introduction of the cultivation of this species is one of the most important events in the economic history of the French colonies: it is the first and most perfect example of cultivation on modern lines undertaken on a large scale in these colonies, and, in spite of the innumerable initial difficulties, it has succeeded beyond all anticipation.

The history of the production of rubber in Indo-China may be divided into three phases:

1. production of forest rubber from lianas;
2. experiments in the cultivation of diffeient rubber plants, the two phases not being separated in time but overlapping one another,
3. the production of rubber from *Hevea*.

A brief sketch is given of each of these three phases.

Trade. - The author gives a short account of the world production of rubber, so that an idea may be formed of the relative importance of the production of rubber in Indo-China.

In 1830, the consumption of rubber amounted to 400 tons only. In 1840 Nelson Goodyear invented the process of vulcanisation: and it was only after this important discovery that rubbei began to be generally utilised. In 1850, 1,400 tons of rubber were produced and consumed; in 1860, the consumption amounted to 2 300 tons: in 1870, to 5,000 tons; in 1880 to 8000 and to 12,000 in 1890.

In 1900 the production rose to 53 400; this was followed by a very slight general increase with certain fluctuations rising slowly to 75,150 tons in 1911. After that, in consequence of the steady development of the production from plantations of Asiatic Hevea, the increase became very marked and rapid.

1912	100,500 metric tons	1918	301,300 metric tons
1913	110,200 » »	1919	332,000 » »
1914	122,300 » »	1920	349,200 » »
1915	161,200 » »	1921	298,700 » »
1916	204,800 » »	1922	409,600 » »
1917	269 900 » »	1923	405,800 » »

Although a French Company was formed a few years ago for establishing a rubber industry in Indo-China, nearly the whole of the rubber produced in Indo-China is exported. Hence a complete idea of the production can be gained by a study of the exports as shown in the *Rapports annuels sur la navigation et le mouvement commercial de l'Indochine* of the Administration of Customs and Revenue (the figures for 1898 to 1904 have been taken from " *Le Caoutchouc en Indochine* " by C. and A. SPIRE).

In 1898, nine tons of forest rubber was exported.

In 1899, 51 tons were exported, nearly all coming from Laos and shipped at Haiphong, and a very small quantity only, viz., three and a half tons, at Saigon.

In 1900, the exports rose to 339 tons of which 300 tons were shipped at Haiphong and 39 tons at Saigon.

In 1901 there was an export of 266 tons, 190 by Haiphong and 76 by Saigon.

In 1904, the export dropped to 177 tons, 164 by Haiphong and 13 by Saigon.

Up to 1918 the exports were small, as the trade was only in the forest rubber and in the output of the first small plantations :

1911	245 tons	1915	377 tons
1912	285 »	1916	546 »
1913	214 »	1917	939 »
1914	195 »	1918	531 »

Then quite suddenly as the result of the tapping of the heveas of the large plantations, the exports showed an immense increase :

1919	2,976 tons	1922	4,623 tons
1920	3,142 »	1923	5,696 »
1921	3,648 »		

Rubber producing lianas. — The author mentions all the rubber producing lianas known in Indo-China, although they now have merely a historic interest. Special studies were made of these plants at the time when expectations were founded on them, by the botanist PIERRE, by HEIN, HECKEL, JUMELLE, SCHUMANN, QUINTARET, C. and A. SPIRE, G. ACHARD, VERNET, CAPUS, BREUGNOT, P. CONTET and YERSIN.

Ficus elasticus and other plants. — Great hopes were at one time placed in *Ficus elasticus*, but for some time past its cultivation has been abandoned. None of the experiments made with other plants (*Castillea elastica, Manihot Glazowii, Tenongia tonkinensis* Stapf, *Bleekcrodea tonkinensis* Eb. and Dub.) gave any permanent result.

Hevea brasiliensis. — The author deals successively with the following subjects: —

1. A botanical study of *Hevea.*
2. An account of the latex.
3. A comparative ecological study of the environmental conditions of the Amazon region and of the Far East, with a longer description of the various conditions of South Indo-China (range of climate, soils, etc.), in relation to *Hevea.*
4. Development of the cultivation of *Hevea* in Indo-China. This cultivation has been developed to a remarkable extent in Cochin-China. On 30 June 1923, nearly 33,700 hectares were under *Hevea*, and the number of trees planted on this area was nearly 8,300,000 of which upwards of 4,800,000 were being tapped. The greater number of the plantations are distributed in the eastern provinces or rather those in the North-East; the provinces of Thodaumont, Bienhoa, Giadinh, Tayninh and Baria.

In Cambodia the area planted in Hevea is still rather limited, and on a rough calculation only 1200 hectares were planted in the region of Kompong-Cham in 1923 But large concessions have been made to important trading companies which certainly take an active part in the production of rubber.

In Annam, the surface planted in Hevea was only 690 hectares in 1923, in the region of Bhatrang.

5. Methods of cultivation.
6. Tapping. In particular a study of alternate tapping, by G. G. VERNET and H. GIRARD
7. Coagulation of the latex.
8. Rubber yields.
9. Diseases of Hevea in Indo-China, (few and unimportant), described by F. VINCENS
10. Selection of Hevea.
11. Economic considerations.

Conclusions — At the end of the article the following conclusions are drawn · — French Indo-China has been but little affected by the recent crisis in the world industry of rubber production. Apart from some plantations of secondary importance which were established at the time when the local exchange was extremely high, even in comparison with gold, the small and average-sized plantations under really careful management as well as the large plantations with considerable capital funds have been able to surmount all the difficulties of the situation. During the acute stage of the crisis, profits could only be made by the plantations where the method of alternate tapping had been adopted; most of the others with their unscientific methods have experienced considerable losses during this period. Government assistance was however forthcoming taking the shape of bounties on exportation and encouragement of mortgage loans.

As M. Auguste CHEVALIER said in 1921: " There is a great future before the Cochin-China hevea plantations and they are capable of great extension. There are still virgin lands of immense extent not yet taken up, which are fertile and easily accessible and where successful plantations could be made. An urgent appeal is hereby addressed to the capitalists of the mother-country for their assistance in bringing these lands under cultivation. At the same time this advice may be given to the planters of Cochin-China. Do not be content to plant only hevea. Side by side with the rubber-tree which will be for the moment the main crop, lay out a number of the plots of your concession in other crops such as cocoa-nut, coffee, tea, palm or sugar-cane :... so as to be in a position, in case at any time there should be no market for rubber, to undertake the cultivation of crops which may possibly be more remunerative after the lapse of some years ". (Indo-China Corr.).

317. **Stick-lac in Cambodia.**

Renseignements du Bulletin économique de l'Indochine, February 1924, p. 78. Hanoi, 30 April 1924

The demand for this product is increasing on the Pnompenh market. The prices ruling (110 piastres per 100 kilogrammes) are an encouragement to future growers, and it is obvious that a rapid development of production is likely. In accordance with a resolution of the Chamber of Commerce and Agriculture, the Agricultural Department is organising the extension of the production of shellac; it is proposed in particular to consign to private individuals at certain fixed periods swarms of the lac insect for placing on the trees.

Up to the present only one application for such a consignment has been made in the Kampong-cham Agricultural Division. In the month of October 1923, M. CHOUPOT, Sub-Inspector of Agriculture, selected a plot of land with trees suitable for the reception of the swarms for the purpose of farming an experimental plot for the production of shellac and also of swarms of the lac insects.

An order was placed on the Laos market for the necessary swarms (50 kg.) and they were supplied from Bassac where a native agent was sent to fetch them. All the arrangements were made in advance ; small baskets for the swarms were collected, the trees freed of brushwood and all parasites removed, and thus the treatment of the trees could begin at once. Up to the present the development of the insect colonies has proceeded normally.

It appears from information supplied by the District Heads that the, natives are beginning to understand that it is to their own interest to respect when making their clearings, the different kinds of trees which are suitable for treatment.

In view of the production of shellac there is a tendency to encourage the establishment of systematic plantation: plantations of shellac yielding trees which receive regular attention, undoubtedly yield a better supply than that generally obtained by gathering in the forest. (From the Report of the Resident in Cambodia, 1923).

318. Requirements for Sugar Production.

WATTS, SIR FRANCIS (K. C. M. G., D. Sc.). *Tropical Agriculture*, Vol. I, No. 6, p. 81. Trinidad, 1924.

The Author draws attention to the fact that sugar production differs essentially from that of crops such as wheat, in that it is a manufacturing as well as an agricultural industry. The manufacturing side imposes heavy restrictions as regards costly machinery and technical supervision. For these reasons beneficial State, or other measures do not produce the immediate response seen in the case of cereals.

During the past 25 years there has been a steady evolution from small plantations with small plants, to central factories of very large capacity. In the West Indies, under the former system, 13 or 14 tons of cane were required to produce one ton of sugar, whereas under modern methods about 9 tons gives the same yield of sugar.

The necessity to produce under modern conditions has caused those places which cannot adopt large scale methods to disappear, as sugar centres. This has actually occurred in Dominica and Montserrat, hence the apparent decrease in total output of sugar in the West Indies On the other hand, the economic basis of production has been improved. These changes have been accompanied by the expenditure of large sums of money on sugar machinery.

It is not sufficient for statistical purposes to judge output over a small period of time. The cultivation of sugar is perennial rather than annual, owing to ratooning. Only by the most careful study of the circumstances underlying changes indicated by trade statistics, can correct deductions be made. W. S. G.

319. Light and Air in the Modern Cultivation of Sugar Cane.

ROSENDEFELD, H. A (Tecnólogo Especial para caña, Estación Experimental Insular, P. R.). *Revista de Agricultura de Puerto Rico*, Vol. XII, No. 1, pp. 237-247, tables 3 San Juan, 1924.

The author considers that this is a once discredited theory which is again being advanced. Mention is made of the different experiments made in connection with this subject and the stripping off of leaves as a source of light and air is discussed. The recent discussions on separate sowings are studied and a short summary of tests in planting at various distances is given, accompanied by an account of experiments carried out (1910-1916) at the " Estación Azucarera de Tucumán " (Sugar Station at Tucuman) on the *Cheribon Morada*, the P. O. J. 36, the 213 and the 228 canes; the Uba, and the Java variety Zwinga were also tested; experiments were made as to yield per hectare as related to spacing in planting.

The author tabulates the results of 17 croppings with P. O. J. 36 and 213, Uba and Zwinga.

The author states that, after carefully examining the question in all its aspects, and taking into consideration the results obtained throughout the sugar producing world, it may be concluded that the sugar-cane

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should be sown as closely as is consistent with adequate cultivation by modern implements. The best spacing distance appears to be about 5 feet for large types of cane such as the Cheribón, Lahaina, B. 208, H 109, B. H. 10-12, S. C. 12(4), etc. and 5 ½ to 6 feet for the more bushy varieties, such as the P. O. J. of Java and the East Indies. E. M. F.

320. Present situation of Sugar-cane Cultivation and of the Sugar Industry in Cochin-China.

PRÊTRE, H. and GUILLAUME, P *Publication du Gouvernement de la Cochinchine*, 79 pages, map. Saigon, 1924

The authors discuss the importance of the sugar-cane in world production and its future in the French colonies; the cultivation of the sugar-cane in Cochin-China (varieties, native cultivation, pests, cost price and selling prices) — the sugar refining industry in Cochin-China, including present position, native sugar factories, European sugar factories.

The article as a whole makes it clear that although Cochin-China is at present backward in sugar production, it is certain that it will eventually become a great and profitable centre for the sugar refining industry, and that there is nothing to prevent such a development.

(1) From the point of view of cultivation, the country is particularly suitable for growing the sugar-cane, and the poor yields obtained are not due either to the temperature, nor the rainfall, nor to the type of soil (which when once under treatment responds well), nor to diseases, but solely to the methods employed, which are of a routine character and are not based on a thorough understanding of the subject

(2) From the industrial point of view, success may be confidently anticipated, as it had already proved possible to obtain excellent rum and white sugar of high quality.

It is important at the present juncture to establish a scientific institute for special work on questions relating to sugar, as has been done in Java and Hawaii.

The authors have attempted to set out certain considerations that might induce capitalists, whether French or native, to invest their funds in the sugar-cane industry and have pointed out that ·

(*a*) cultivation of the sugar-cane and sugar refining, taken separately, and a fortiori in combination, were remunerative for the native, in spite of the defective methods followed and of the employment of an entirely rudimentary equipment;

(*b*) the Dutch and the Americans have been most successful with the sugar industry in their colonies, owing to the adoption of scientific methods;

(*c*) there is no chance of achieving similar results in Cochin-China, unless definite use is made of modern methods which naturally require progressive action and a large capital backing;

(*d*) the sugar crisis, like the rubber crisis, gives no real cause for alarm, in view of the continued increase in world consumption and the large demand for sugar in Europe and in the Far East.

In conclusion, they lay stress on the two following facts which are both highly important:

The sugar cane, being an annual, gives a return from the end of the first year, which means that the capital sunk in the industry is quickly realisable, that is, if the shareholders are not so unreasonable as to demand high dividends in the first years, and also makes possible the rapid extension of the plantations.

If the shareholders are careful to form the business capital in piastres (and it is here that the co-operation of Chinese-Annam finance may perhaps be of value), the exchange cannot influence the working of the industry until the point of saturation of the local and the Far East market is reached, which is not within sight for many years.

No other important colonial crop except rice offers the same advantages. rubber, coprah, coffee, cotton, oil palm, etc. are grown under widely differing conditions. Sugar-cane yields much more per hectare than rice and the local market price of sugar is more stable than the price of rice. Moreover, during the early years, with a duty placed on sugars imported from Hongkong, Singapore, Java, etc., there would be no foreign competition to be feared in Cochin-China.

In conclusion, everything points to the development of the cultivation of sugar-cane and of the sugar refining industry in Cochin-China and this promising French colony may in time, if it chooses, take a place among the principal sugar producing countries of the world.

(Indo-China Corr.).

321 Tobacco Fertilisers.

BEETS A N J Bemestingsproven 1919-20, 1922-23 *Proefstation voor Vorstenlandsche Tabak*, Mededeeling No L, p 66, 1924.

The following are the results of the tests made with various fertilisers:

Lime Its value as a fertiliser in heavy soils is shown by the good results obtained at Djoewiring.

Dessa earth and stable manure They have a considerable and beneficial influence on the total yield, the length of the leaves and the quality of the crop, but may, in certain surroundings, cause infection by *Phytophthora nicotianae*

Ammonium sulphate Has no effect on length of leaves if applied when the soil has been fertilised with Dessa earth and stable manure, which are necessary for light soils and which cannot be substituted by sulphate of ammonia.

Nitrate of soda. The above remarks also apply to this fertiliser.

Urea. Urea contains up to 45 % of nitrogen and would be more economical than sulphate of ammonia. Compared with the latter, on light soils it gave sometimes better, sometimes similar and sometimes inferior results.

Phosphates. The results did not indicate that a better yield was obtained by the application of phosphates.

Tobacco-seed cake. This cake gave good results, comparable to those obtained with Dessa earth and stable manure. In practice, however, it is not possible to obtain a sufficient quantity for plant requirements.

Ground-nut cake gave good results as regards length of leaves.

Guano (from bats) contains too low a percentage of nitrogen to be suitable.

A. F.

322. Tobacco Cultivation in Ukraine.

POPOFF. Vidrodgenia i soutchasni stan ukrainskoi tutunovoi promislovosti. *Vistnik Silsko-Cospodarskoi Naouki* (1), Vol. III, liv. 1-2, pp. 21-26. Kharkov, 1924.

The author gives a statistical review of the tobacco industry in Ukraine and shows that after a period of depression, it has begun to recover appreciably since the year 1923.

The War and subsequent events affected the cultivation of this plant much more than the manufacture of its products, the factories having been able to continue work for some years on the stocks of leaf-tobacco which had been accumulated. The area of tobacco plantations, which before the War covered as much as 26 thousand hectares, had fallen in 1921 of 100 hectares. In 1922, half the factories which had survived, 6 in number, were united in a Trust, partly under State control and this new organisation undertook to infuse new life into the production of the raw material. From the year 1923 onwards, the Trust arranged to sow 6000 hectares and to encourage private planters by financial advances; it was hoped that in this way cultivation would be revived over about 10 thousand hectares, and that a crop of about 250 000 q. of leaf-tobacco could be obtained. It should be noted however that this tobacco is of a special kind, and resembles neither the American tobacco (for cigars) nor the Turkish type of tobacco (for cigarettes). The greater part of the tobacco cultivated in Ukraine (especially in the Provinces of Chernigoff and Poltava) belongs to a very coarse species, with thick, giant leaves, known in Russian as "makhorka"; it is used only as a pipe tobacco, by the peasantry and the poorer classes of the towns people The Turkish types of tobacco are in Russia only cultivated in large quantities in the Crimea and Caucasus regions, which are outside the Ukrainian Republic. A certain quantity of the Turkish type of tobacco, however, is cultivated in the Ukrainian province of Podolia, and the author remarks that recently the cultivation of this type is beginning to spread also in the Provinces of Chernigoff and Poltava.

The author draws attention to the importance of tobacco cultivation, which, in his opinion, should become one of the principal branches of agriculture in Ukraine, there being a tendancy everywhere to intensify cultivation and increase crop production.

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(1) Journal of Agricultural Science, published by the Scientific Agricultural Committee of Ukraine.

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323. The Habit of Budded Cacao.

HARLAND, Prof. S. C. and PARGA, R. G. *Tropical Agriculture*, Vol. I, No. 9, pp. 132-133. Trinidad, 1924.

The Cacao tree grown from seed has two kinds of branches, which differ in the arrangement of their leaves: these are, the main axis type or chupon, and the fan or palm type, known in Trinidad as the " jorquette ". The cacao tree is thus dimorphic in its branching system.

These facts led the authors to study whether the prevailing habit of budded cacao is due to the type of bud used for budding, and it was found that buds are always taken from fans and not from chupons. The conclusion reached was that monomorphic (fan) trees result from the use of buds from fans.

Experiments were then carried out on the River Estate of the Trinidad Department of Agriculture to ascertain under what conditions if any, a dimorphic type of budded cacao could be produced. The experiments showed that, fans when pruned generally produce fans from the topmost bud and any others which may develop. It is, however, possible for fans to produce chupons. Out of 59 pruned fans, 57 gave fans, and 2, both from the same tree, gave chupons. Chupons generally gave rise to chupons, and from a close examination of pruned chupons which gave fans it was concluded that there was no clear case of a chupon which had already forked, producing a fan after being pruned below the fork.

From these experiments it is clear that if buds are taken from chupons instead of from fans, an entirely different sort of tree will result.

Which of the two types is agriculturally the better should now be the subject of further investigation.

W. S. G.

324. The Qualities in Cacao desired by Manufacturers.

The Journal of the Jamaica Agricultural Society, Vol. XXVIII, Nos. 2 and 3, pp. 64-67. Jamaica, 1924.

Many growers of cacao would be assisted by knowing what qualities in cacao are considered desirable by manufacturers of cocoa and chocolate, and the following notes have been written with a view to supplying that information.

In gathering the crop, the planter should take care that only ripe pods are picked. This would be facilitated by planting one variety only on a plantation. If gathered too soon the beans are small, flat and tough and the shell is difficult to remove, also, unripe beans do nor ferment normally. Over-ripe beans ferment rapidly, the shells are fragile and the roasted cacao is inferior in quality.

Beans which have germinated give an inferior final product, with a herbal odour and an astringent taste ; even a small percentage of such beans is objectionable.

Unfermented cacao is always saleable, but at a lower price, as the final cocoa is inferior in colour, odour and flavour. Lack of cleanliness during fermentation causes objectionable flavours, and the same result is caused by exposure to bad odours.

After fermenting, it is usual in some countries to remove the pulp by washing. This practice leaves the shell thin and fragile and renders the cacao more liable to insect attack, also, the unwashed product is said to keep better.

It is essential that beans should be throughly dry before packing. Sun-drying is preferable to artificial drying.

The product should be freed from shrivelled beans and rubbish ; waste should never exceed 0.5 %.

Claying improves the appearance, but the practice is open to abuse, e. g., using more than 1 % of clay or masking black cacao from diseased pods, by claying.

Dancing and polishing improve the appearance of the beans, but it is doubtful whether it is worth the extra cost.

Large beans are preferred to small beans as they have a lower percentage of shell.

Manufacturers object to flat beans because they shell less evenly, have a greater percentage of shell, do not roast so evenly, and are usually evidence of unripeness, or insufficient fermentation or careless drying.

Cacao moths should be kept away from the cacao while drying, or their eggs are deposited on the beans, into which the larvae eat their way.

Probably the most highly appreciated character is constancy of quality ; careful grading would result in higher market prices.

W. S. G.

325. Opium Experiments in Spain (1).

BENAIGES DE ARIS, C (Prof. at the Higher School of Agricultural Experts). *Ingenieria y Construcción*, Nos 15 and 16, pp 127-268, figs 5. Madrid, 1924.

The author first describes the reasons which led him to take up the study of opium and the agricultural difficulties, and the possibilities in Spain of specialising the most varied crops.

The tests were made by the author from 1915-1918 at the experimental and demonstration grounds of the "Granja Escuela práctica de Agricultura" at Valladolid. The characteristic features of the fields are: height 700 m., frequent winds, those from the north being cold and those from the south-west deprived of moisture ; minimum temperature from —5 to —6° C.; total precipitation under 350 mm. (in the years 1917-18, 286 mm.); evaporation 4-8 times the precipitation as estimated by the instruments for measuring rainfall.

In these conditions tests were made on the white opium poppy, *Papaver somniferum*, and on the obtaining of opium. In the village of Mojados (Valladolid) the opium poppy was already available, as its capsules and seeds are exported for oil extraction; in Spain opium poppy-seed oil is not used.

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(1) See *R.* No. 937, 1924. (*Ed*).

The price of opium during the test years was 50-300 pesetas per kg. owing to its great scarcity, which induced the author to undertake the experiments.

At first the experiments were made on dry, loose, sicilious soils; plots were sown at the end of September. The result was negative because all the conditions were unfavourable. Only on one lot, in which the plants were slightly protected, did the severe frosts (8 and 12°C.) not have the same effects as on all the others, which were exposed.

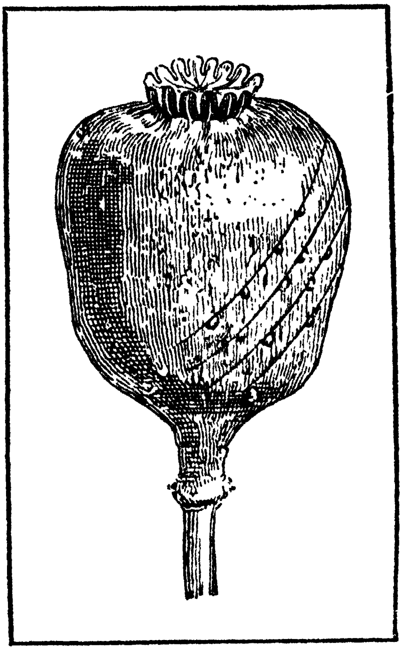

FIG 93. — Opium poppy capsule with four diagonal incisions from which exude drops of opium. The opium is collected with small spatulas and dried in the sun in suitable vessels, in which form it is sent to the market.

In the district of Mojados the opium poppy is cultivated in low-lying, sandy, clay-lime soils. Though dry, they are better than those of Granja. The subsequent experiments made by the author were carried out on the moist soils of Granja.

After these first trials, the author experimented in the moist zone: (1) On sandy and very moist soils; (2) On sandy-clay soils.

1) *On sandy and very loose soils.* — The author describes all the operations carried out, commencing with sowing on the 15-16 April, until the harvest on 17-27 June. Sowing was done in three ways: broadcast; scattering on hilly ground; in drills on the plain. The last gave the best results, for it allowed cultivation of the soil during the growth period, after each rainfall, with the light plough patented by the author and which he uses for his "double row system" in surface dressing for wheat.

Incisions were made in the fruits one by one (Indian fashion) by hand with small knives (Fig. 93), so that the cuts did not penetrate the epicarp. This process is slow and the yield is small. Three series of incisions were made: the first gave about 8.48 kg.kg. of opium per ha.; the second, 5.38 and the third, 2.69 kg. The opium from the 1st incision contained 10.5 % of morphia, and that from the 3rd, 7 %: 45 % of oil was extracted from the seeds.

The opium thus obtained was costly and the economic yield of the opium poppy small.

2) *On sandy-clay soils.* — These are better than the preceding ones for cultivating the opium poppy. The latter was introduced in the follow-

ing rotation: 1st year, peas; 2nd. year, opium poppy; 3rd. year, broad beans; and 4th year wheat.

In this test the seed was sown in double rows. There was a distance of 50 cm. between the single, and of 70 cm. between the double rows. The plants in the rows were about 20-30 cm. apart. The sowing was done in March with small drills. The author gives all details relating to: preparation of the soil — manure — watering — thinning-out — gathering.

Under the heading "Means tried for reducing cost of gathering" the author gives some interesting data. In the first tests, made by means of incisions with knives, 39 days of 6 hours each were required for 30 000 capsules, or 128 capsules per hour, and a period of 175 days per ha. As the date of the harvest coincided with that for cereals, labour was scarce and dear.

It was necessary to increase the yield which was done by the adoption of straight incisors (in the Persian style) instead of single knives. These did not give good results because they cut the capsules only at the tangential points, and the knives soon lost their edge. The author then devised the jointed scarifiers (Plate XLV, Figs. 94 and 95) the knives of which adapt themselves to the irregularities of the capsules, and make 5 incisions at a time. The scarifier is easily taken to pieces. The knives have a saw-like edge and hence be come less clogged. With these scarifiers incisions were made in the 30 000 capsules in about 70 hours, or 429 capsules per hour and about 88 days were required per ha. In gathering the opium, time to the extent of over 50 % is economised by using separate receptacles, the author however says that the time must be greatly reduced in order to make the process of industrial value.

Conclusions drawn from these tests. — (1) The white Armenian opium poppy grows well in the climate and soils of Spain; (2) in the Castillian table-land (the characteristic features of which are the same as those of the Granja de Vallodolid) the yields of opium poppy capsules are as much as 1 500 kg. per ha. In the Granja the following was obtained on an average: 17 686 gms. of opium with 10.91 of morphia and 1472 kg. capsules, with 725 kg. of seed, per ha.; (3) the morphia yield from the first incision (scarification) was 11.13 %; (4) in very sandy soils the opium does not thrive, moisture (in Spain) being indispensable. The best yields were obtained on the sandy-clay, and somewhat limy, soils; (5) sowing should take place as early as possible; 4-5 kg. of seed should be sown per ha. at a depth of 1-1 ½ cm.; a thin layer of farmyard manure or straw and a small amount of water favour growth; (6) spacing varies according to climate, and the rows should always be in the direction of the prevailing winds; (7) second dressings are always very advantageous; (8) the plants should be thinned out and superfluous flower-buds nipped off; (9) it is advisable to carry out scarification before the fruits lose their blueish colour and become brownish; (10) the greatest yields are obtained on calm and warm days, hence plantations should be protected from cold winds; (11) the greatest difficulty with regard to this cultivation in Europe is the obtaining of labour, hence it should be reduced as far as possible in the following way: (*a*) by gathering as early as possible so that this period

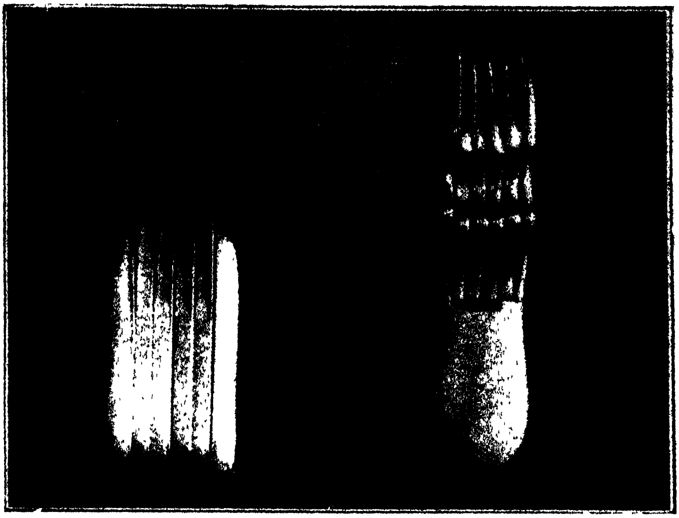

FIG. 94. — Tool with jointed blades adjustable to the irregular surface of the poppy capsules, used for making incisions; side view.

In the model shown on right the fore finger is placed on the projection of the handle, in such a way that the blades adjust themselves to the capsule.

The model on left is held between the thumb and middle finger; the fore finger is placed on the back of the handle. The two models were made for the experiment described in the article.

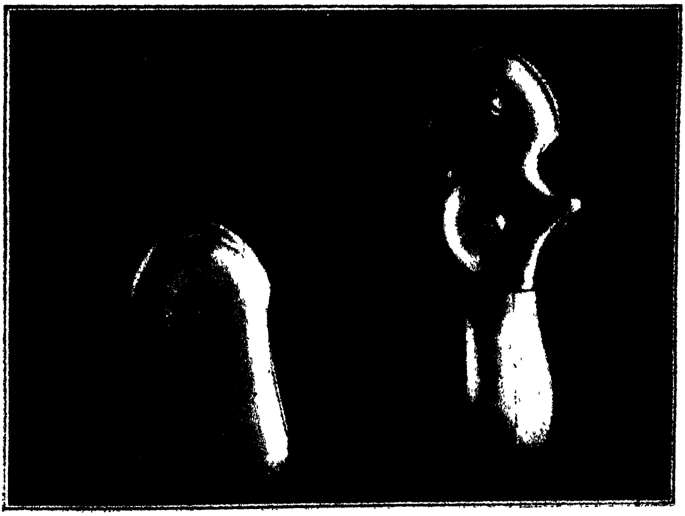

FIG. 95. — Tool with jointed blades for making incisions in opium poppy capsules. Front view of author's model.

does not coincide with that of the ordinary harvest; (*b*) by reducing the number of capsules per ha. and increasing the size and yield by selection and the use of fertilisers; (*c*) by facilitating harvest operations by grouping in double rows with pathways between; (*d*) by utilising female and child labour, jointed scarifiers, and individual containers for collecting the opium. (12) It would be well to study methods for obtaining the opium or the morphia only from the newly pulled plant by certain physical or physico-chemical processes, without destroying the value of the seed.

The author concludes by drawing attention to the uniformity of the product and believes it would be well to form associations for the production of commercial standard types, under State control, like tobacco, and for the packing in casks and furnishing with a guarantee based on analysis, in order that the opium of the West may meet with favour on the market.

E. M. F.

Horticulture and Arboriculture.

326. The Production of Pineapples.

Tropical Agriculture, Vol. I, No. 6, pp. 85-86. Trinidad, 1924.

The article gives a brief account of the pineapple industry, with special reference to Hawaii, where in 1903 the output was only 1893 cases, whereas the estimated output for 1925 is 10,000,000 cases. Great development has also taken place in Florida, Cuba and the Azores.

Two instances of failure are discussed, the first being that of Florida, where the industry was almost extinguished, although now revived. This failure was due to exhaustion of the soil humus and to wilt, or red wilt associated with a parasitic root nematode, the attack of the worm perhaps being due to plant weakness caused by soil depletion. To avoid soil exhaustion proper cultivation and manuring must be given; areas which are infested with the nematode can be freed by growing two or three crops of Natal grass, and certain varieties of cow peas, on the roots of which the nematodes cannot live.

Some years ago a set-back occurred in Trinidad, but in this case it was due to inadequate experience in canning and distribution, which requires more knowledge of organisation and more capital than does the production of the pineapple. Standardized packing and crating is essential.

The success in Hawaii has been largely due to mass production, propaganda and advertising.

The « Red Spanish » variety is one of the best for shipping as fresh fruit, whereas Smooth Cayenne is the variety most grown in Hawaii for canning; in Cuba the Sugar Loaf variety is grown for local use.

The article concludes with a description of methods of canning employed in Hawaii.

W. S. G.

[326]

327. Practical Advice on Long Pruning.

MESTRE, A. (Director de la Estación Enológica de Felanitx, Mallorca). *El Cultivador Moderno*, Year XIV, No. 11, pp. 10-11, 3 photos, 2 illus. Barcelona, 1924.

The author describes the object of pruning, systems of pruning, principles of plant physiology applicable to pruning, choice of a system of pruning, increased yield obtained through long pruning, kinds of long pruning of which a trial is recommended, long spiral pruning, Costet long pruning and Floret long pruning.

Bearing in mind certain principles of plant physiology the author concludes that the object of pruning is " to obtain a maximum of fruit to the detriment of growth energy, at the same time however maintaining sufficient energy to avoid weakening the stock ". For this reason the choice of the system of pruning cannot be made in a very general way, but each stock must be considered individually. Not all varieties lend themselves to a particular system of pruning ; long pruning must be applied on deep soils, and other factors must be borne in mind such as soil fertility and fertilisers.

The following results of tests at the Enological Station at Villafranca de Panadés were obtained by long pruning :

Xarel-lo Variety — grafted on Aramon × Rupestris No. 9.

Year	Short pruning — Production per hectare	Long pruning — Production per hectare	Notes
	kg	kg	
1911	1 059	16 127	In the year 1911 the spring frosts completely destroyed the crop on the short-pruned lot. On the other hand little damage was done to the long pruned crop because the shoots were farther from the soil The year 1914 was characterised by drought ; owing to careful cultivation, long pruning was applied without detriment to the stocks. Note the low yield in 1915 owing to severe attacks of mildew.
1912	4 634	28 344	
1913	7 840	23 613	
1914	7 421	15 593	
1915	4 509	20 349	
1916	7 332	22 500	
1917	9 006	23 721	
Average	5 071	21 184	

Intensive production through long pruning somewhat reduces the alcoholic strength of the wines. From the *Xarel-lo* variety grafted on *Aramon × Rupestris No.* 9 the alcoholic strengths were : 11.6 % after short pruning and 11.1 % after long pruning.

From the *Subirat Parent* on 1202, the strengths were 12.7 and 11.65 respectively.

The author recommends that in each vineyard the vine-grower should set aside a small part of the vines, some isolated stocks, for pruning tests. Nothing would be lost thereby and on the other hand he might

PLATE XLVI.

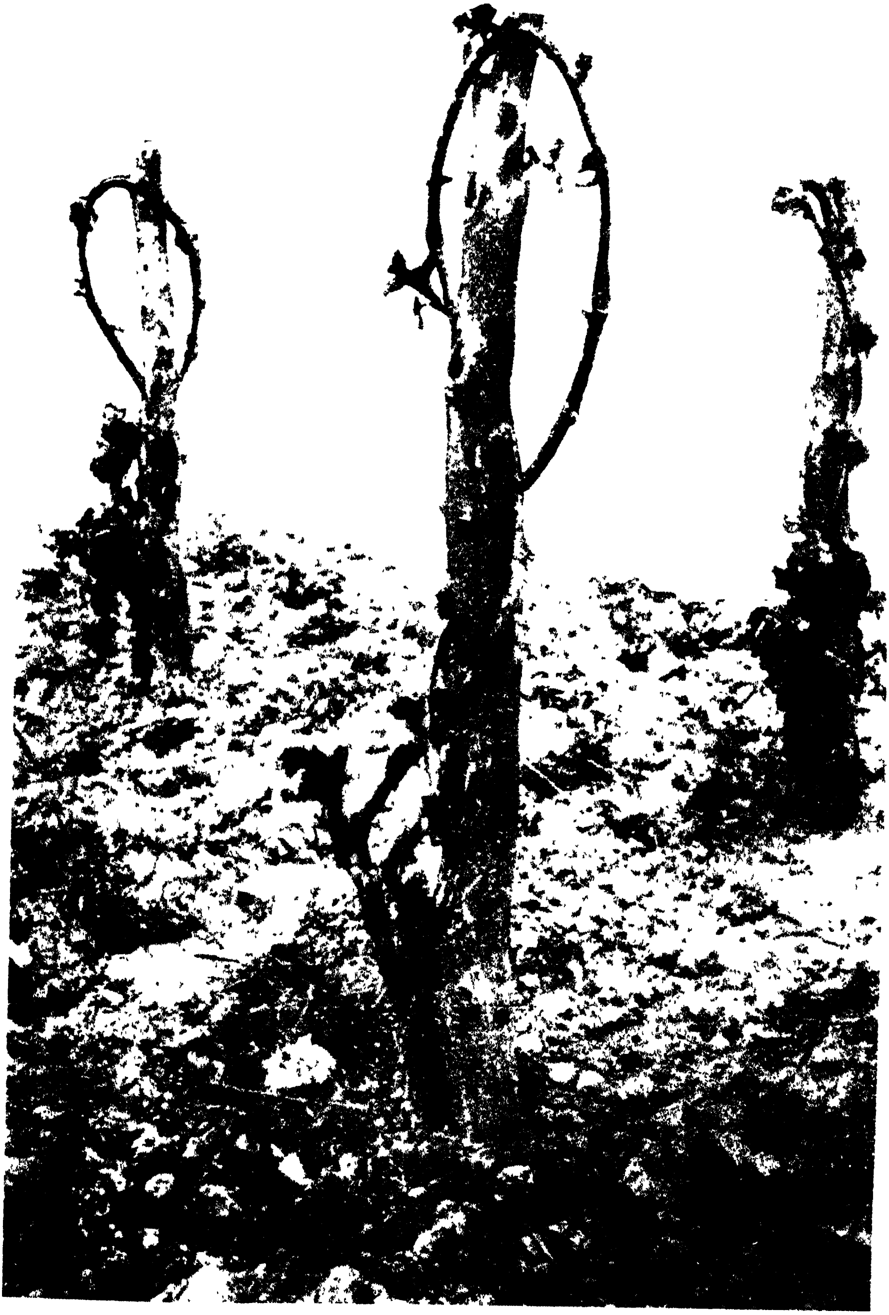

FIG. 96 – System of long pruning tried in the Experimental Field of the Enological Station at Felanitz (Mallorca)

Subirat Parent Variety, grafted on Mourviedro × Rupestris No. 1,202.

Year	Short pruning — Production per hectare	Long pruning — Production per hectare
	kg.	kg.
1912	9 953	29 127
1913	7 491	22 340
1914	4 681	10 800
1915	7 029	17 121
1916	8 715	21 358
1917	8 209	23 080
Average . . .	7 689	21 310

benefit considerably. The GUJOT, ROYAT, SYLVOZ and CASENAVE, are systems of long pruning, but are not advisable, except in rare cases, owing to their costly installation and to the necessity of establishing them as soon as the vineyard is planted.

The author recommends the Costet-Floret and *long spiral system*, in preference to those systems in which not all the vineyards can be treated in the same way. The ideal of the vine-grower should be to produce high yields at a low cost, rather than to cultivate many plants.

At the Enological Station at Villafranca de Panadés, 21,500 kg. per hectare were obtained on dry soil. A. M. F.

328. Plane Tree Investigations.

BRETZLER R. Beiträge zur Kenntnis der Gattung Platanus *Botanisches Archiv*, Vol VII, Parts 5-6, pp 388-417. Königsberg, 1924.

The author deals chiefly with the differentiation of the various species of plane-trees, basing on the dispositions and behaviour of the reproductive organs G. B.

LIVE STOCK AND STOCK BREEDING.

General.

329. Damage caused by the Golubatz Fly in Roumania: its Attacks on Animals and Man.

CIREA, T. (Professor of Pathology, Faculty of Veterinary Medicine, Bucarest) and DINULESCU, G. (Veterinary Captain in the Roumanian Army). *Annals of Tropical Medicine and Parasitology*, Vol. XVIII, No. 3, pp. 323-342, plates 3, 1 map, figs. 8, bibl. Liverpool, 1924.

In Europe, one of the greatest sources of Simulies is the Golubatz fly, which, in Yugoslavia, originates from the Departments of Pojarewatz and Craina, and in Roumania, from the Banat Departments of Timiš, Torontal and Caras-Severin.

From these breeding-grounds, in the spring of nearly every year, the Golubatz fly invades some of the Departments of Transylvania and Oltenia, in more or less dense swarms. The inhabitants of these Departments are well acquainted with the fly and the means for protecting the livestock, and so the damage is not great.

But in 1923 two swarms of Simulies left the Department of Caras-Severin, and directing their course, one towards the north and the other towards the east, invaded 17 Departments of Roumania, or one-eighth of the total area of the Country; at the same time 7 Departments of Yugoslavia and 3 of Bulgaria were invaded. An examination of the map of the area invaded shows that the fly followed a course at right angles to that of the water-ways, which indicates that they were carried by the wind. The Simulies are transported shorter distances by accompanying the animals they desire to attack.

According to official information, during the invasion, the Golubatz flies in Roumania killed 16,474 domestic animals, viz., 1585 horses, 60 asses, 10,592 cattle, 28 buffaloes, 915 sheep, 460 goats and 2834 swine.

In Yugoslavia 1552 animals were killed, and in Bulgaria, in the Department of Widin, they destroyed 1500 animals. The value of the latter was 63,059,000 lei (1), to which should be added the losses caused by the cessation of agricultural work which resulted.

It was observed that the punctures were mortal only during the first 4 or 5 days of the invasion: the authors believe that a certain state of immunity was established in the animals which had escaped a first attack.

The Golubatz fly settles on the body of the animals, especially on the mucous of the natural orifices and on the most delicate parts of the skin; it buries its proboscis deeply in the skin and remains fixed there until gorged with blood. The animals bitten start and take to flight, enter the water, or go into the stables. Those with a black coat are attacked more than the others.

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(1) 800 lei = 75.15 Fr. francs in 1923 = £ 1. 0. 0.

The flies are aggressive from sunrise until 10.0 a. m. and from 4.0 p. m. until the evening; during the middle part of the day and the night they remain hidden.

Blood oozes from the punctures, which, according to their number, form bleeding patches of varying extent; when the bites are numerous, a hard and painful inflammatory oedema is formed.

The animals which are severely bitten show symptoms of imminent asphyxia and death ensues after a few hours. When the attack is less violent, the symptoms are less accentuated, lasting 6-7 days, and then death follows. The typical position assumed by the animals attacked is the sterno-abdominal decubitus. At the autopsy, congestions and degeneracy of the heart, liver, kidneys, etc. are noticed.

The preventive measures are: on the arrival of the fly, to keep the animals in dark quarters during the day, and send them out to pasture or work during the night. In order to prevent the flies from entering the stables, burn dung near the door. To protect the animals while grazing or at work during the day, raise smoke round them.

Dress the most vulnerable parts with preparations of absinthe, walnut, hazelnut or tobacco leaves, also mineral or vegetable tar with rancid hog's lard or ordinary hog's lard.

As curative measures, massage, poultices of brine or brine and vinegar, ammonia lotions, cold baths and ice are used.

As internal remedies, the following cardiac tonics are used: infusions of coffee and fox-glove and injections of caffein. Bleeding is also resorted to.

The veterinary surgeons state that many animals which had been severely stung by the fly were slaughtered and their meat was consumed without danger.

The authors investigated the attack of the Golubatz fly on man, and described the general and local symptons, the treatment and prophylaxis.

P. D.

330. Influence of Insulin and Glucose on Milk Secretion and Composition.

NITZESCU, I. I. and NICOLEAU, C (Institute of Physiology of the Faculty of Medicine, Roumanian Biological Society, Cluj Section) I. Influence of Insulin on Milk Secretion. *Comptes rendus des séances de la Société de Biologie et de ses filiales*, Vol. XCI, No. 37, pp. 1462-1463. Paris, 1924. II. Influence of mono- and disaccharides, in an intravenous injection, on the composition of milk. *Ibidem*, p. 1464, Paris 1924.

I. — The object of the investigation is to observe the variations in milk composition under the influence of sub-cutaneous injections of insulin.

The tests were made on two ewes, in full milk, separated from their lambs.

For more than a month before and throughout the test, the ewes were kept on strict rations ; one received 1 kg. of oats and 2 kg. of dry hay daily, the other, fresh hay *ad libitum*. They were milked 3 times a day ; at 8 a. m., 12 and 8 p. m. The insulin was injected sub-cutaneously in the ewes at 8 o'clock in the morning, after the first milking ; the glycemia was determined in the jugular blood before the injection, and 2 and 4 hours after, and the next morning before milking. After 2 or 3 days the injection of insulin was repeated. The test led to the following conclusions :

(a) *Quantity of milk* : as regards the first ewe, the quantity of milk from the 3 milkings showed about the same variations on the day the insulin was given as on the days without insulin. As regards the second ewe there was a slight decrease after the injection of insulin, especially at the evening milking ; this decrease seemed to continue the next day.

(b) *Fat* : The percentage of fat, which even in normal conditions fluctuates greatly between one milking and another, often show a slight increase after the insulin.

(c) *Lactose* : The percentage of lactose is remarkably constant on the days without insulin. After the injection it decreases, especially in the evening milk ; the decrease continues, but to a less extent, the next day. It must be observed nevertheless that the decrease is rather slight when the hypoglycemia is considerable, and that the lactose is still reduced when the degree of glycemia has again become normal.

(d) *Nitrogen in the casein and total nitrogen content of the milk* : Slightly and irregularly influenced

(e) *Inorganic phosphates* : after injection, slight increase of mineral phosphate in the evening's milk , this increase even continues to a slight extent the next day.

II. — Modifications in milk secretion after intravenous injections of glucose and similar compounds.

The experiment was carried out on the same ewes as in test I, with same feed and same times of milking. On the third day of the test, glucose (30-40 gm. in 100 cc) was injected into the jugular vein the morning after the first milking. After 2-3 days there was a second injection (60-80 gm. of glucose) and after 1 or 2 days, a third. The following were also injected : levulose, galactose, maltose and saccharose (1-2 gm. per kg. of live weight in 100-150 cc.).

The quantity of milk and the fat content show the same variations on the days of injection from one milking to another as on the other days. The lactose undergoes unimportant modifications, even during considerable hypoglycemia or after copious injections of glucose.

The lactose in the blood is therefore distinct from that of the mammary gland.

The results of tests I and II prove that the mammary gland retains an evident autonomy as regards lactose secretion and produces this secretion in a very constant manner in spite of wide glycaemic variations.

P. D.

331. Influence of Light Rays on Calcium Content of a Normal Growing Organism.

LESNE, E., TURPIN, R. and ZIZINE, P. *Comptes rendus des séances de la Société de Biologie et de ses filiales*, Vol. XCI, No. 37, pp. 1378-1379. Paris, 1924.

In order to investigate the influence of light on the total calcium content of a normal growing organism, the authors divided a litter of 6 rats into 2 lots : 3 of these animals were subjected, 15 days after birth, and for 15 minutes daily, to the rays of the quartz-mercury lamp ; the other 3 rats were used as controls and not subjected to the rays.

All other conditions were identical for the 2 lots.

After 30 applications the total calcium content of each lot was ascertained, and the following results were obtained :

	Lot 1 (irradiated) gm.	Lot 2 (control) gm.
Total weight	143	134
Ca as oxalate (total)	3 684	3 168
Ca as metal (total)	1 151	0.990
Ca per 100 gms of the animal	0.865	0.739

These figures show the eutrophic influence of the rays of the quartz-mercury lamp on the development of a normal growing organism and the parallel variations of the total Ca content ; they lead one to foresee the successful application of artificial light in the preventive treatment of rachitism and a tendency to spasms. P. D.

332 The possible Significance of Exose Phosphoric Esters in Ossification.

ROBINSON, R. and SOAMES, K M (Department of Biochemistry and Experimental Pathology of the Lister Institute) Part. I. The possible significance of exose-phosphoric esters in ossification. Part II. The Phosphoric Esterase of Ossifying Cartilage. *The Biochemical Journal*, Vol. XVIII, Nos. 3-4, pp. 740-754, 2 plates. Cambridge. 1924.

DAVENPORT, KAY H and ROBINSON, R Part III. The Action of the Bone Enzyme on the Organic Phosphorus Compounds in Blood *Ibidem*, pp 755-764.

The phosphoric esterase discovered by one of the authors (ROBINSON) in ossifying bones and cartilages, is found in the same proportion also in the teeth, especially of young animals. This enzyme quickly hydrolyses the exoso-monophosphoric and glyceroshosphoric esters, liberating phosphate-ions. The greatest hydrolytic power however is possessed by the liver, spleen and pancreas, while the non-ossifying muscles and cartilages are quite deprived of it.

The optimum P_H for such enzyme is found on a curve between 8.4 and 9.4 in a zone, that is favourable to the precipitation of tri-calcium phosphate and calcium carbonate.

The enzyme in the bones may be differentiated from that in the pancreas, liver and spleen, in that it has comparatively no influence on the phosphoric esters.

The deposit of phosphate of lime in the bones taken from rachitic rats and immersed in a solution of exosomonophosphate and glycerophosphate of lime at 37°, with P_H 8.4-9.4, has been proved by experiment. These tests lead one to conclude that the hypothesis that this enzyme takes an active part in ossification, is well founded, and prove that it is secreted in the osteoblast region and that of the hypertrophic cartilaginous cells. The high P_H might be attributed to some mechanism which renders the fluid more alkaline than blood and thus favours the action of the enzyme.

The organic phosphoric compounds soluble in acid existing in the blood of various animals, are formed of at least two phosphoric esters, one of which is rapidly hydrolysed by the enzyme of the ossifying cartilage and the other resists the latter. The quantity of esters thus hydrolysed reaches 14-36 % of the total phosphorus soluble in acid.

These esters are in the corpuscles but not in the plasm. When the bone extract acts on the whole of the blood, it increases the quantity of inorganic phosphorus in the plasm, which probably indicates that the esters can spread from the corpuscles to the plasm.

The phospholipin in the blood is not hydrolised by the enzyme in the bone. A. F.

333. Changes in the Chemical Composition of the Tissues of the Herring in relation to Age and Maturity.

BRUCE, J. R (Marine Biological Station, Port Erin). *The Biochemical Journal*, Vol. XVIII. Nos. 3-4, pp. 469-485, bibl. Cambridge, 1924.

The author has chosen as a criterion in judging of the age of the herring, the winter rings, and has selected for examination examples homogeneous as regards sex and maturity.

It was found that at a certain stage of sexual maturity, the water, fat and protein content depend on age, inasmuch as the older fish have a lower percentage of water and protein and a higher percentage of fat.

Sexual maturity has the same influence on composition as age. It was observed indeed that individuals at the same stage of sexual development, arranged according to increasing age, show similar variations in the proportion of water to fat and in the protein content, as individuals in successive stages of sexual development, but presumably of the same age. The older and larger herrings, with a full development of spawn and " milt ", have greater nutritive calorific value than the younger fish, even when mature.

The metabolic requirements for the growth of the sexual glands are mostly satisfied by the fat reserves of the liver ; the muscular tissue is not touched unless for a very short time before spawning.

The sexual glands also need phosphorus and phosphatic compounds

(lecithin, etc.), which are important in the changes which take place in the tissues at the time of sexual maturity. A. F.

334. Stimulating Influence of Vitamine Preparations on Growth.

Krizenecky, J. and Podhradsky, J. (Institute of Zootechnical Research at Brno, Chekoslovakia). *Revue de Zootechnie, la revue des éleveurs,* Year 4, No. 1, pp. 31-36, graph. Paris, 1925.

In the authors' researches on vitamines, they have observed their action when above the necessary normal minimum, beyond which pathological troubles begin, they have tried to determine the higher limit, the physiological optimum of the effects due to an increase of vitamines.

The quantity of vitamines in the rations is increased by the aid of vitamine preparations, thus rendering it unnecessary to overload the organism with superfluous quantities of nutrient substances

1st Test Made with 6 white mice, including males and females of the same litter, weighing, after weaning, from 3.4 gm. to 4.3 gm. For a week they received rye-bread and wheat and barley meal, they were afterwards divided into 2 groups of 3, weighing respectively

1st group; 4.52, 31,80 and 4.50 gms (test group)
2nd » 5.56 4.19 and 4.75 » (check group).

The test group received, in addition to the above ration, small pieces of bread dipped in a water solution of the product to be tested. Each mouse thus received about 0.03 gm. of the dry matter of this product per day. The mice were weighed daily or every other day for 22 days. The influence of the product was shown and caused an increase of 32.7 % more than that of the other group.

2nd Test. on 4 young male rabbits of the spotted Czechoslovakian breed from the same litter, aged 14 weeks.

They received oats and green food, 2 of them also had a vitamine product, with which the oats had been moistened, to the extent of 5 5 gm. per day After the test had been carried on for 92 days, the following results were obtained

Check rabbits				Rabbit receiving vitamine products			
Initial weight	Final weight	Increase in weight	Increase in % of initial weight	Initial weight	Final weight	Increase in weight	Increase in % of initial weight
kg.	kg.	kg.	%	kg.	kg.	kg	%
0.865	1.570	0.705	81 5	1.215	3.970	2.755	155.14
1.125	2.260	1.135	100.89	0.950	2.970	2.020	213.63

The average stimulating effect on growth is thus 50.95 %.

3rd Test : at the poultry farm at Potstyn on poultry of the Bresse and Faverolle breeds, various preparations, Z_1, Z_2, Z_3, being used

[334]

The groups compared were formed of 5 young pullets and 5 young cocks of each breed ; 1 gm., and later 2 gm., of the products were added to the ration per day per bird.

The feed common to all groups was :

(1) a mixture of flour $(^2/_7)$, wheat bran $(^2/_7)$, crushed maize $(^2/_7)$ and bone and meat powder $(^1/_7)$; one part of the mixture was in the form of a paste, the other was dry and given without limit;

(2) maize meal, morning and evening, in quantities of 25, 35 or 45 gm. according to the progress of growth.

Increases in weight after 40 *days, in* % *of initial weight.*

	Bresse		Faverolles	
	Cockerels	Pullets	Cockerels	Pullets
Check groups	192 99	191.67	168.61	184.24
1st group tested with Z_1 . .	220.68	217 95	203.53	228.47
2nd » » » Z_2 .	199.08	204.45	206.81	188.03
3nd » » » Z_3 . .	203.26	207.32	168 45	184.01

Conclusions :

(1) The product Z_1 has always had a stimulating effect on growth ; the increased weight of the fowls as compared with those which did not receive the product was 25 % for the Bresse cockerels and 23 % for the Bresse pullets, 15 % for the Faverolle cockerels and 23 % for the pullets.

(2) The product Z_2 did not stimulate growth to a marked extent except in the case of the Faverolle cockerels.

(3) The product Z_3 did not stimulate growth.

(4) The stimulating effect of Z_1 may be expressed as the decrease of time necessary to obtain the same weight ; this decrease, with respect to the weight reached by the check group at the 122nd. day, is 26 and 30 days for the Bresse groups and 42 and 49 days for the Faverolles. This is an economy of feed equal to the strictly necessary ration for 37 days on an average.

(5) The increase in growth due to Z_1 continues beyond the period during which it was given as a supplement ; it is therefore a case of a reinforcement of the vital processes and an increase of the nutrient exchanges.

(6) The results cannot be interpreted as the consequence of an insufficiency of vitamines in the ration of the check groups, for no pathological phenomena took place.

(7) Similar results in the case of farm stock other than poultry would be of considerable economical importance.

P. D.

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335. Antirachitic Properties imparted to Inert Fluids and to Green Vegetables by Ultra-Violet Irradiation.

HESS, A. F. and WEINSTOCK, M. (from the Department of Pathology, College of Physicians and Surgeons, Columbia University, New York). *The Journal of Biological Chemistry*, Vol. LXII, No. 2, pp. 301-303, Plates 8, bibl. Baltimore, 1924.

Various inert fluids were irradiated with a mercury vapour lamp, in order to ascertain if it were possible, by this means to impart to them antirachitic properties.

The authors found that cottonseed and linseed oil could thus be rendered specifically active.

After irradiation, these oils, at the rate of 0.1 cc. per day, were capable of protecting rats, receiving a rachitigenous diet, from rachitism. Consequently an antirachitic factor has been produced *in vitro*, independently of the action of any living organism. The irradiated oils were able to store and keep this antirachitic factor for a long period of time.

Wheat, etiolated by being grown in the dark, possesses no antirachitic properties, whereas, when cultivated in the open air and irradiated with a mercury vapour lamp, it can protect rats, subjected to a rachitigenous diet, from rachitism.

The same difference as regards their protective influence against rachitism was observed in the case of green vegetables subjected to irradiation after being gathered. Green lettuce leaves have no preventive properties, whereas after irradiation they possess antirachitic properties.

This shows that the production of an antirachitic factor is completely independent of growth phenomena and due to irradiation. During their tests, therefore, the authors have, by irradiation, produced an antirachitic factor, both *in vitro* and in growing plants.

P. D.

336. The Size of Animals and the Laws of Bergmann and Dèpèret.

REINSCH B. Das Dépéret Gesetz und die Regel von der Kleinheit der Inselformen als Spezialfall des Bergmannschen Gesetzes und ein Erklärungsversuch desselben. *Zeitschrift für induktive Abstammungs und Vererbungslehre*, Vol. XXXV pp. 136-155. Leipzig, 1924.

According to BERGMANN's law, among animal races the larger types live in the colder and the smaller in the warmer climates, the law being based on the principle of the economy of heat in relation to size.

The law of DÉPÉRET declares on the contrary that in the race development of the animal kingdom, there is a progressive increase in size and that in other words the race lines began with the small types and finished with the large.

In the author's opinion the law of DÉPÉRET is merely a special case of the law of BERGMANN, if allowance is made for the climatic variations bound to occur before the third stage of descent is reached. G. E.

337. Modification of the Coat in Mammals.

Kröning F. (Zoolog. Institut der Universität Göttingen). Über die Modifikabilität der Säugerscheckung. *Zeitschrift für induktive Abstammungs- und Vererbungslehre.* Vol. XXXV. Part 2, pp. 113-138, 21 illustr. 1 plate, bibl Leipzig, 1924

For investigation of the inheritance of the marking of the coat in mammals the study of double, exceptional forms, is of great use, from the point of view of ascertaining the symmetry of the distribution of the centres of pigmentation In this article the conclusion is reached that there is usually in the case of mammals a symmetrical (metamerous) arrangement of the centres of pigmentation in five pairs of centres.

G. B.

338. Value of Methods of Milk Testing.

Laplaud, M., De la Fregonnière and Duffau De la valeur des méthodes de contrôle laitier *Revue de Zootechnie, la revue des éleveurs,* Year 3, No 10, pp. 239-247. Paris, 1924.

The " Commission Technique d'Organisation et de Controle du Centre National d'Expérimentation Zootechnique des Vaulx-de-Cernay " carried out experiments on the testing of milk to ascertain to what extent the results agree of tests made daily, weekly, fortnightly, once every three weeks, and monthly

The test was made on 10 cows of pure Normandy breed from the same farm, over a complete lactation period, of average yield of milk, and kept under the same conditions, i. e. milked twice a day, fed in the same way and looked after by two equally capable dairymen

To avoid all possibilities of variation all animals of very high milk yield were excluded, as were the final periods of lactations The number of samples tested was 5256 ; the quantity of milk, the fat content, acidity and density were determined.

During the test the cows received in winter the following ration. beets and fine straw 10 kg , oat-straw 7 kg., hay 5 kg.; concentrated feeds (bran, ground-nut cake and maize gluten) 2-3.5 kg., and in summer, from April to September, they were pastured, with the addition in July, August and September of 16 kg. of fodder peas per day

The lactation period averaged 263 days, varying from 206 to 363 days ; the yield was slightly over 10 kg. per cow per day during the milking period and 7.3 kg per head per day throughout the year.

The results were recorded month by month of each day's tests, then lactation by lactation ; the arithmetical averages of each lactation gave results which were compared with the arithmetic averages of the samples taken each week, fortnight, three weeks and month.

The extent of variation was thus ascertained for tests made weekly, fortnightly, every three weks and monthly, as compared with the daily tests.

The variation in the averages for the evening is generally greater than that for the morning. The corresponding variation for the day is nearly always less than the smallest variations either in the morning or the evening.

Quantity of milk. — The variations as compared with the daily tests are not proportionally higher with the lengthening of the period, taking each cow separately.

The maximum variations observed were : 3.53 % for the weekly tests ; 5.81 % for the fortnightly, 8.1 % for the 3-weekly (4 times in 10) ; and 9.95 % for the monthly tests (6 times in 10).

The variations as compared with the daily tests are on the contrary proportionally greater as the period increases, taking the average results for the 10 cows. They are : 1.04 %, 1.48, 2.08 and 2.68 %, respectively, for the weekly, two-weekly, three-weekly and monthly tests.

There are two causes of variation which are as important as the periodicity of the tests : incomplete milking and error in weight. The former depends on the conscientiousness and skill of the milker, the latter is practically 1-2 % with the instruments usually employed. There is no compensation, but coexistence of errors, and consequently the daily testing of quantity may be no more exact than the periodic test.

Fat content. — The variations as compared with the daily tests are not proportionally greater as the period lengthens, taking the average results for the 10 cows.

Maximum variations observed in the case of :

Test made	Cows taken separately	Average result for the 10 cows
Weekly	4.3 %	1.30 %
Fortnightly .	6.64 %	1.87 %
Every 3 weeks	11.7 % (3 times in 10)	2.90 %
Monthly	9.9 % (6 times in 10)	2.[illegible]7 %

The variations due to incomplete milking and errors in weight may be considerable. The error in reading by the controller may be 2.5 % daily for the fat content.

Acidity. — The variations for the 10 cows, as compared with the daily test are proportionally higher as the period increases. The maximum variation is that of the monthly control, which is above 2 %.

Density. — The variations for the 10 cows, as compared with the daily test, are proportionally greater as the period increases.

The maximum variation is that of the monthly control, which is below 1 %.

P. D.

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Special.

339. The Horse in Indo-China.

TRICARD, A. *Bulletin économique de l'Indochine*, Year XXVII, No. 166, III, 1924, pp. 209-230, 6 plates. (Reprint under separate cover).

The native horse. — The Indo-Chinese breed of horse at one time included a variety of types possessing a number of common characteristics, as although the area of French Indo-China is larger than the area of France by one-fourth, these different types, belonging to parts of the country lying at considerable distances from each other, have never displayed any such differentiation as that which separates, e. g. the 'percheron' from the 'tarbais' or the Norman breed from that of the Landes.

These types half a century ago, constituted pure, although closely allied, breeds known as the Cambodia, the South Annam, and the Tonkin.

At the present day the purebred horses have almost disappeared, for apart from the crosses between neighbouring breeds, the foreign elements, which were introduced through the cavalry horses of the army of conquest, and afterwards with the object of improving the breed in Indo-China, have brought about modifications of the original characteristics. Among such elements were Arabs, Bretons, Polish horses, Tarbais, Tartar, Landes and Australian breeds.

It is however possible to give the outline characteristics of the Indo-Chinese horse as for a single type, as follows:

Horse of small height (1m.15 to 1m.28), proportioned generally on small lines. The strong head is supported on a short thick neck, with a bushy mane; the withers are often thick and ill defined; the back is wide, usually short and rarely saddle shaped; the loins well attached but sometimes concave as a result of too early working; the croup is inclined to sag; the chest is wide and fairly deep. The barrel is round, the rump and shoulder muscular; the legs, which are often rather short, are strong and the extremities delicate and sound; blemishes are exceptional, but the hind legs are usually crooked and the hocks are close together.

To sum up, the type appears apart from the height to be a composite of two French types: the Breton type in the forequarters and the ordinary mare of the South of France in the hindquarters.

The coat is usually light, either grey or dun, but there is considerable variety owing to the number of crossings. To-day the grey coat is less often seen.

The Indo-Chinese horse possesses excellent qualities due to his sanguine temperament and thickset conformation. He is full of energy, works hard, resists fatigue well and is at the same time hardy and docile. His agility and surefootedness are remarkable and are comparable to those of the mule or the ass.

As he is a steady worker, he is eminently adapted for hard pack-saddle work on the mountain paths. Going at an even pace with relatively heavy loads of 50 or 60 kilogrammes, he can accomplish long stages by difficult roads, narrow, slippery and with constant obstacles which he scrambles over without attempting to leap.

· The horse of the country is usually good-tempered but sometimes obstinate and capricious. His feet constitute an undeniably strong point, as the hoofs practically resist all wear and tear. .

His weakest point, as a sadle horse for Europeans, lies in the height and general conformation : his action is not easy, the difficulty being increased by the high centre of gravity of the whole mass of horse and rider, the seat is insecure and the saddle is apt to shift from not fitting well over the rounded shape of the flank.

For his build the Indo-Chinese horse is remarkable for the rapidity of his paces. At his usual walking pace he goes 7 km. an hour ; he is besides trained by the native from his earliest years to amble, which is with him quicker than trotting. It is very exceptional for him to be galloped.

Some degeneracy in the Indo-Chinese horse is noticeable and strong hardy horses of 1.25 metres to 1.30 in height have become a rare exception. The decline in numbers already remarked in the native breed does not apply, strictly speaking, to the part of the country where breeding goes on, but to the centres where there is a demand for good horses for ordinary use. As a matter of fact, production is nearly stationary, while the quality has deteriorated and the demand has increased. There are evident signs of a want of equilibrium between demand and supply, and at the same time degeneracy in the breed. The author is making a study of the causes of this state of affairs.

Improvement of breed. – In regard to the improvement of the Annamite horse, there was a period of careful breeding up to 1900 ; from that date an experiment was tried of which a very widespread application should have been made from 1906, by the importing of 450 mares, though this importation should have been carried on for a longer period ; a period of inactivity followed, the experiments being however continued in the Annam breeding stations, and since 1920 there has been a serious resumption of activities.

The production of the half-blood is essential : to arrive at the three-quarter breed the half breed is required ; but the obtaining of the half breed is not to be considered as an end in itself, it is merely an intermediate though essential step. It must not therefore be generalised. It is the three-quarter breed that must be produced and must interbreed in order to fix the type of the true improved Annamite breed.

The Breed Improvement Council in Indo-China met in October 1919. It continued work into 1920, and since February a report has been issued in which the resolutions of the Council were thus formulated :

1) Import of stallions of the breed known as 'Mogods', from the Regency of Tunisia ,

2) New regulations for the breeding premiums, which are to be mainly awarded on results, also formation of the Stud-book ;

3) Establishment of intermediate stations for Army Remounts,

4) Compulsory castration of army horses, and if possible in the country districts castration of the horses not required for breeding;

5) Annual Agricultural Show.

The author discusses the following: castration, stallions, premiums, transition depots (where colts are kept which have been bought very young with the object of eventually being used as Army remounts), shows, race meetings.

The following are his conclusions:

Is the horse tending more and more to disappear in Indo-China with the advent of the motor-car? More than one provincial chief and the higher branches of commerce seem to have lost interest in the horse. This attitude of mind must not be allowed to continue. Races, premiums for breeding establishment of transition depots are factors of first importance in this sense.

The high cost of labour will also, sooner or later, make it necessary to employ horses for the drawing of carts and drays to which now, as may be seen every day even in the towns, men, women and children are harnessed.

The rickshaws will disappear more or less quickly as a result of the increasing cost of labour and also as education becomes more diffused. They will be replaced by the horse, as may already be seen in the Philippines, where the town of Manilla has 6 000 carriages with two seats without taking into account the 10 000 motor cars in use.

In addition in the event of mobilisation of the forces, Indo-China may have to recruit the necessary horses on the spot.

The efforts made shall prove successful. It is not as if it were a question of introducing a new animal into the country, and difficulties of climate, problems of acclimatisation, or uncertainties as to food had to be met, it is simply a question of renewing the breed of horses, of re-establishing and even increasing the production. Neither high prices nor the success of the motor-car enter into the question. The two methods of locomotion can prosper side by side in their respective spheres. What is wanted is agreement as to the outlook and the maintenance of the financial credits required by the programme adopted: since 1920 the central Government in the first place, and afterwards the local Government of each district, have set aside each year larger credit and have shewn themselves very favourably disposed to the adoption of the measures proposed, including that of a transition depot, which is the real key stone to any scheme of horse breeding. The future may be regarded with confidence. (Indo-China Corr).

340. The Decline in Breeding of Light Horses in Austria.

WETTENGL (Advisor on Horse-Breeding to the Government of Lower Austria). Die Hengstenbewegung in Niederösterreich im Jahre 1924. *Die Landwirtschaft,* Part 1, 15. January 1925. pp. 2. Vienna, 1925.

In consequence of the reduced demand for light horses, due to the increase in the number of motorcars and the disbanding of some of the cavalry regiments, there has been a falling off in the breeding of horses of this type, while the breeding of heavy horses has increased. While the number of the government stallions of the light horse breeds was reduced in the course of the year 1924 from 49 to 39, only 25 mares on an average were served The number of the heavy horse stallions rose from 75 to 78, serving on an average 34 mares. Out of the 79 private stallions 28 belonged to the heavy horse breeds, 23 were trotting horses, 12 were English thoroughbreds and 16 belonged to the different light horse breeds. On an average only 14 mares were served by these stallions A small addition was made to the number of the government stallions of the Hoflinger type, a small light breed, which enjoys considerable popularity.

H. K.

341. Effect of Feeding Cabbage and Potatoes on Flavour and Odour of Milk.

BABCOCK, C J (Assistant Market Milk Specialist, Bureau of Dairying). *United States Deartment of Agriculture, Department Bulletin* No 1297, pp 12, ill 10, graphs 1 Washigton, D C, 1924

Results of tests made by the Bureau of Dairying at the Experimental Farm at Beltsville, Md., in order to determine : (*a*) If cabbage and potato feeds affect the flavour and odour of milk ; — (*b*) how to distribute these feeds and treat the milk in order if possible to reduce the effect on the milk to a minimum

In the tests the author used 6 Holstein and 10 Jersey cows.

The animals received as a maintenance ration, in quantities varying according to the quantity of milk produced, the following mixture maize gluten 100 kg., bran 100 kg., oats 100 kg., linseed cake 50 kg., cotton cake 50 kg., and in addition, as much as the animals would take of lucern hay.

The cows were divided into groups of 4

1st group : maintenance ration + hay (check).

2nd group maintenance ration + hay + 15 lb. of cabbage or potatoes fed 1 hour before milking.

3rd group maintenance ration + hay + 30 lb. of cabbage or potatoes fed 1 hour before milking.

4th group : the same as the 3rd group fed immediately after milking.

Samples of milk were taken from each cow during milking, the milk was cooled but not aerated.

In order to judge of the effect of aeration on the flavour and odour of the milk produced by a cow fed as above, samples were also taken of the milk after it had been allowed to run over a surface refrigerator.

These tests gave the following results

The consumption of 14.3 lb. of cabbage 1 hour before milking causes a disagreeable odour and flavour in the milk. If the quantity consumed is increased from 14.3 to 24 lb. on an average, the odour and flavour of the milk are considerably intensified.

If the animal consumes 25 lb. of cabbage immediately after milking, the milk has a disagreeable odour and flavour.

Suitable aeration considerably decreases the odour and flavour imparted to the milk by the cabbages and suffices to eliminate a slight odour and flavour developed before aeration.

The flavour and odour caused by cabbages are slightly less pronounced in cream than in milk.

A consumption of 14.8 lbs. of potatoes 1 hour before milking causes a very slight abnormal odour and flavour, rarely noticeable in the case of most animals. If the quantity be increased from 14.8 to 29.8 lb. the flavour and odour of the milk are not accentuated; 28.7 lb. of potatoes immediately after milking has no effect on the flavour and odour of the milk. P. D.

342. Influence of Diet and Sunlight on the Vitamine Content of Milk.

LUCE, E. M. (Department of Experimental Pathology, Lister Institute). The Influence of Diet and Sunlight upon the Growth-promoting and Anti-rachitic Properties of the Milk afforded by a Cow. *The Biochemical Journal*, Vol. XVIII, Nos. 3-4, pp. 716-739, 3 tables, bibliography. Cambridge, 1924.

The milk from the same cow is subject to remarkable variations as regards its anti-rachitic and growth-promoting properties.

The cow's diet is probably the main factor in determining the growth-producing value. When the cow has a diet of green fodder the milk possesses a growth-promoting value much larger than if fed on dry feed, deficient in fat-soluble vitamines These results are the same whether the cow is kept in sunlight or in a dark cowshed and it would therefore seem that no conclusions as to the action or otherwise of light can be drawn from these experiments.

The anti-rachitic properties depend on the diet of the cow, and probably on the degree of illumination to which it is exposed.

The milk of cows, kept in open pasture, has a marked and high anti-rachitic value, while if the animal is kept in a dark cowshed, it yields a milk much inferior from the point of view of its effect on rachitic conditions.

It is not improbable that the seasonal incidence of rickets among children has a definite relation to these facts, in so far as the milk would have a higher anti-rachitic value in summer than in winter. A. F.

343 Influence of Epizootic Abortion on the Milk and Butter Production of Normandy Cows.

LEROY, A. and RECOURA, M. G. Influence de l'avortement épizootique sur la production laitière et beurre des vaches normandes. *Comptes rendus des séances de l'Academie d'Agriculture de France*, Vol. X, No. 35, pp. 109-101. Paris, 1924.

During an epidemic of infectious abortion the authors had the opportunity of investigating the irregularities in the milk and butter production caused by premature calving of a Normandy breed of cows subjected to milk testing. The data obtained from tests carried out on 24 animals were examined, and the quantities of milk and butter yielded by each in 10 months were estimated after normal calving on the one hand, and abortion on the other.

The lactation estimates were corrected to make allowance for the influence of the date of calving and the age of the cows. After a normal calving the average yield for each of the 24 cows rose to 3 576 kg. of milk and 171.2 kg. of butter ; after an abortion, on the contrary, the corresponding average yield was 3 235 kg. of milk and 117.6 kg. of butter.

While the average fat content of the milk was 4.2 % in the former case, it rose to 4.4 % for the 24 abortion lactations.

It seems therefore that after a premature calving due to infection, the cows yield a smaller quantity of milk with a slightly higher fat content.

The authors then endeavoured to ascertain what relation there is between normal yields and those after abortion, they found that there is little or no relation between the period of gestation and the deficiency of milk production.

The following is a summary of the conclusions drawn :

1) Epizootic abortion decreases by about 33 % the quantities of milk and butter that can be obtained from a cow during a period of normal lactation.

2) The milk yields after abortion, for a period of 10 months, appear to be in close relation to those found after a normal calving.

3) The duration of the abortive gestation only very slightly affect the decreases in milk and butter production during lactation after premature calving.

4) The effects of abortion can, to a certain extent, be likened to those of a previous lactation continued up to calving, without apparent mammary rest.

It is perhaps because it causes premature lactation, without previous mammary rest, that abortion produces the above-mentioned effects.

P. D.

344. The Lagrenée Sheep Breed : a successful Cross in Tunis.

GINIÈS La race ovine Lagrenée , un croisement heureux pour la Tunisie. *Revue de zootechnie, la revue des éleveurs.* Year 3, No. 10, pp. 280-283 tables 6. Paris, 1924

With a view to the production of an early maturing, well-formed breed, with good quality meat and strong wool, of an improved type, and at the same time as resistent to " Hamra " (a solar erythema caused by the action of the sun's rays on animals which have eaten a variety of St. John's wort, called " hamra " by the Arabs) as the native breed, Mme. LAGRENÉE crossed the Algerian ewe with the Solognot ram, both having a white fleece and red extremities. The introduction of a French breed was not possible, for, owing to their depigmentation, the various French breeds are attacked by hamra. The native Barbary breed with a large tail presented many drawbacks : poorness of meat, hypertrophy of the caudal appendix necessitating the intervention of the shepherd during service and causing numerous cases of sterility due to the shepherd's negligence

The Algerian Barbery with red extremities " and the " Solognot " were then crossed. The latter is a small sheep, slender and long in line, with excellent meat, vigorous, hardy, requiring little attention, and very resistent to aqueous cachexy, hornless, with a white fleece having red extremities and with the skin of the whole body pigmented. The hair on the head and limbs is fine, glossy and bright red. The brown pigmentation of the skin renders it almost immune from the attacks of " hamra ".

The " Algerian Barbery with red extremities " is small and thick-set, with well-developed horns and white fleece ; the head and limbs are red, being covered with rough, dull, coarse, pale-red hair. The tail is thin, and the milk capacity developed.

On the whole, the Solognot-Barbery sheep form a homogeneous and well-defined group. The animals are about 65 cm. high at the withers and weigh on an average 50 kg. ; they generally have no horns ; the hair underneath and the skin are completely pigmented or pied-red ; the fleece is white or reddish-white and the extremities are bright red in colour. The fleece is not full, as it stops short behind the nape of the neck, along the cervical knot at the juncture of the neck and shoulders and at the upper third of the fore and hind legs , it sometimes stops at the neck, at the stiflejoint and at the line of the rump, and in exceptional cases covers the throat and the larger part of the belly. The fleece is loose, not thick, with pointed tufts and dry, uneven, coarse wool ; the weight found was as follows :

In 1919,	1 358	kg.	per	fleece	at	the	age	of	42	months.
1920,	1 240	»	»	»	»	»	»	»	5	years
1921,	1.140	»	»	»	»	»	»	»	6	»
1922,	1.025	»	»	»	»	»	»	»	7	»

The animals are quiet, hardy, agile, good walkers and easy to rear ; their meat is of good flavour and owing to the pigmentation being spread all over the body, they are still more immune to the attacks of " hamra " than the native sheep of which only the extremities are coloured.

The females are comparatively early-maturing. P. D.

345. Goat-Keeping in Malaga.

EGANA, S. C. (Veterinary Inspector for the Province of Malaga) *Revue de Zootechnie, la revue des éleveurs*, Year 3, No. 8, pp. 132-141. Paris, 1924

The Malaga or coast goat is small (averaging 65-70 cm.) ; the he-goats are larger, but do not exceed 75 cm. The length of the body from the breast to the pubis is 70-80 cm. The head is small, broad, the profile straight with a tendancy to convexity. The horns are placed high, straight up and curving backwards, forming a perfect arc, the ears large and pointed and inserted perpendicularly to the cranium. This goat has a fore-

PLATE XLVII.

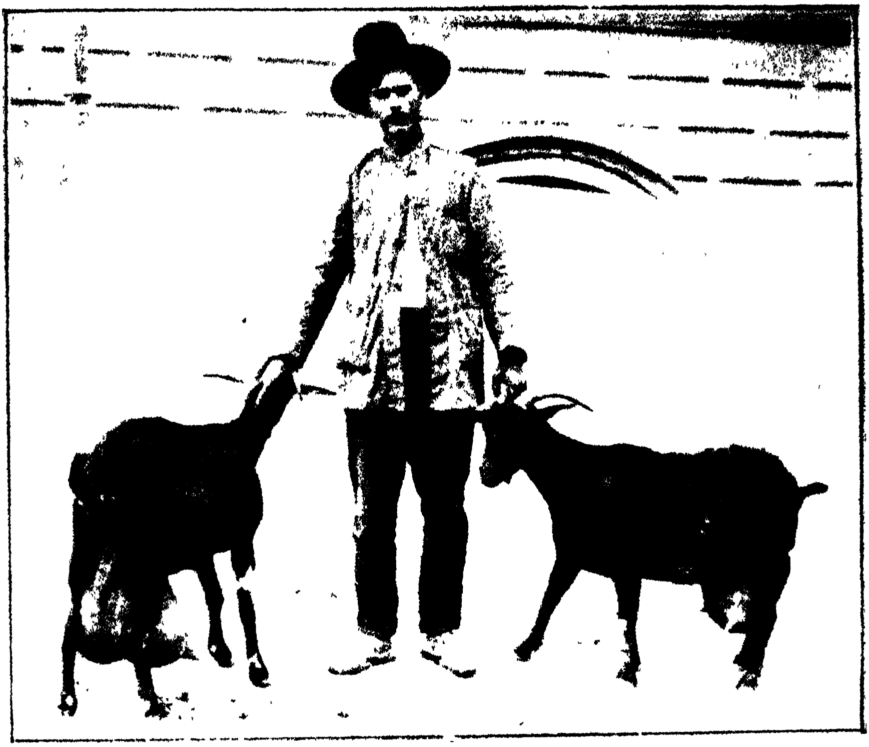

FIG. 97. — Types of Malaga goats.

lock, beginning at the " chignon " and falling over the forehead, and a very short beard, which is sometimes absent in the she-goats.

The shape of the trunk is a parallelogram, the vertebral column is straight, slightly saddle-backed and more so in the females than in the males.

The typical form of the udder is considered to be globular or pouch-like ; the juncture of the teats shows great variation ; that most preferred is the union at the base of the udder and perpendicular to the ground Breeders look for an udder rich in glandular tissue, without any obstructive ligament extending the udder and increasing its volume without increasing the yield.

The Malaga goat has long hair over the whole of the breadth of the vertebral column and on the thighs ; over the rest of the body the hair is soft and short. The ends of the long hairs are generally lighter in colour than the rest of the coat. These characteristics regarding covering have undergone more or less extensive alteration in consequence of cross-breeding. The coat is light and of varied tones , some animals are black.

A Malaga she-goat yields 400-500 litres of milk ; she generally bears two kids (in 90 to 95 % of cases). At the time of giving birth the yield reaches 3-4 litres of milk per day , with good milkers, well fed and reared scientifically, this yield is maintained for 3-4 months ; the yield then falls to 1-1 5 litres, but remains at the latter figure for a long time.

On small farms the goats are not well fed nor of good type. On giving birth they generally yield 3 litres of milk ; after 1 or 2 months the yield falls to 1 litre per day.

To ensure a continued yield by the herd, the breeding time is divided into 3 periods

(*a*) the early kids at the end of summer or in autumn, the lactation period is short ; (*b*) the " nursing " (kids) in December or January, the longest period of lactation ; (*c*) the " late " kids, at the end of spring or beginning of summer ; average lactation period

The method of milking is closely related to yield , the Malaga goat-keepers leave a certain quantity of milk in the udder and do not continue milking regularly but with frequent interruptions. They have observed that a goat which is emptied in milking becomes quickly exhausted and produces less.

The Malaga goat is bred for its milk. The goat-keeper or " Churretro " has 20 or 30 she-goats and takes them to the town ; the large owners follow the same system except that milking is done at the farm and the milk is carried to the town.

Feeding is mixed ; the goats eat what they can find out of doors, and on returning to the stable receive a ration of broad beans, a feed which it has been impossible to replace by maize, carobs, etc. If there is no pasture available the goats are led along the roads and feed on olive and eucalyptus branches, lucerne, cactus, green maize tops and agaves, and afterwards receive their ration of broad beans. The agave is the best of these feeds. Only the ration of broad beans is measured the rest are distributed approximately. Many keepers crush the broad beans, which is more economical; about 1-2 kgs. of beans per head per day are fed. Feeds being cheap and the milk fetching a good price, profits are large, especially for the keeper who sells his produce direct.

Keepers are not in the habit of letting their goats breed, for the rearing of the kids is very troublesome. The best animals produce for 4-6 years and are finally sent to the butcher.

The meat is generally sold at 2.50 to 3 fr. per kg. The skin is greatly valued for making the leather receptacles for containing oil. The open skins fetch 3-4 pesetas each (1 peseta = 1 fr. at par), whole skins 6-7 pesetas and buckskins even more.

The *Velez* fair is the most important market; a young goat in kid is valued at 75-100 pesetas; one-year olds 15-17 pesetas, and choice animals more In judging a she-goat, the keepers only attach importance to the udder, especially, to its feel; it must not be " pasty " and should be of a fine pink colour, with prominent veins. P. D.

346. The Mineral Metabolism of the Growing Pig.

RICHARDS, M. B., GODDEN, W., and HUSBAND, A. D. (Rowett Research Institute, Aberdeen). The Influence of Variations in the Sodium-potassium Ratio on the Nitrogen and Mineral Metabolism of the Growing Pig *The Biochemical Journal*, Vol. XVIII, Nos 3-4, pp. 650-660, 3 figs, bibliography. Cambridge, 1924.

The object of these researches is to ascertain the effect of additions to the cereal rations of sodium chloride which, according to some authorities, increases the rate of growth. In reality the effect is, like that of sodium citrate, to promote the assimilation and retention of nitrogen, calcium and phosphorus.

Increased quantities of sodium salts in the feed stimulate the excretion of potassium in the urine, an increase in this respect being always considerable, even after a fortnight of regular administration of the salts.

The excessive excretion of potassium in the urine is more or less counterbalanced by the diminution in the faecal excretion. There is accordingly only a slight deviation from the normal, even during the period of abnormal urinary excretion. The result of these observations is to show that in investigations of this kind it is essential to undertake analyses of the faeces and urine at one and the same time, if serious error is to be avoided. A. F.

Poultry.

347. The Shape and Weight of Eggs in Relation to the Sex of Chicks.

JULL, M. A. and QUINN, J. P. Bureau of Animal Industry, U S. Dept. of Agriculture). *Journal of Agricultural Research*, Vol. XXIX, No. 4, pp. 195-201, 8 plates Washington, D. C., 1924 (received in 1925).

In order to determine the relation between the form of the egg and the sex of the chick, the length and maximum breadth of each of 990 eggs laid by 24 Barred Plymouth Rock pullets between the middle of February and the end of April, were measured at the time of laying. The sex of the chicks was determined by dissection at hatching time.

Of the 990 eggs, 512 produced males and 478 produced females, the mean length of the eggs producing males is 55.31 ± 0.06 mm. and the mean length of the eggs producing females is 55.42 ± 0.07 mm., that is, a mean difference between the two sexes of 0.11 ± 0.09, or a variation, which is both absolutely and relatively, very slight. If the production of each pullet is considered separately, it is observed that among 13 individuals the mean length of eggs producing males is greater than the mean length of eggs producing females, and that with 11 other individuals the reverse is the case.

The shape of the eggs was determined by the length-breadth index obtained by dividing one hundred times the breadth by the length. A long and narrow egg has a low index, while a short and broad egg has a high index. The mean index of eggs producing males was 75.17 ± 0.09 and that of eggs producing females is 75.09 ± 0.10, or a mean difference of 0.08 ± 0.13.

For the study of egg weight in relation to the sex of chicks eggs from two different sources were examined : 1. eggs obtained from 153 Barred Plymouth Rock females mated to Rhode Island Red males; 2. eggs from 58 Rhode Island Red females mated to Rhode Island Red males.

The weights of 418 and 226 eggs in the former and latter cases respectively or 644 eggs in all were considered, the eggs being weighed daily as laid.

Of the 418 eggs from the Barred Plymouth Rock females, 347 hatched and 71 died in shell at hatching-time.

Out of the 347 eggs hatched there were 190 males and 157 females. The mean weight of the eggs producing males was 58.64 ± 0.19 gm. and the mean weight of those producing females was 58.53 ± 0.21 gm., a mean difference of 0.11 ± 0.28 gm.

Out of the 71 eggs whose chicks died in shell at hatching time, 30 males and 41 females were identified.

The mean weight of the eggs producing males was 57.56 ± 0.44 gm., and that of the eggs producing females was 57.82 ± 0.32 gm., i. e. a, mean difference of 0.26 ± 0.61.

Taking the results for all the 418 eggs, the mean weight of the eggs producing males is 58.49 ± 0 17 gm. and the mean weight of the eggs producing females is 58.45 ± 0.19 gm., a mean difference of 0.04 ± 0.25

Out of the 226 eggs from the second source, the mean weight of the eggs producing males is 58.06 ± 0.26 gm. and the mean weight of the eggs producing females is 57.29 ± 0.27 gm., or a difference of 0.77 ± 0.37.

Taking all the 644 eggs into consideration the following figures are obtained : mean weight of eggs producing males, 58.24 ± 0.14 gm.; mean weight of eggs producing females, 58.01 ± 0.16 gm.

The mean difference is thus 0.23 ± 0.21 gm.

In conclusion it may be stated .

There is no correlation between the absolute length of an egg and the sex of the chick hatched from it.

There is no correlation between the shape of an egg and the sex of the chick hatched from it

There is no correlation between the weight of an egg and the sex of the chick hatched from it. P. D.

348. Laying Competition at Klosterneuburg, Austria.

WIENINGER (Councillor, Technical Adviser on Poultry-breeding to the Federal Ministry of Agriculture and Forestry) *Bericht über die ersten Leistungsprüfungen der Hühner am Wettlegehof in Klosterneuburg in ersten Legejahre* 1923-1924. 31 pages, 11 illustrations Vienna, 1924.

A poultry farm with special arrangements for laying competitions (*Wettlegehof*) was established in 1923 at Klosterneuburg near Vienna, on the model of the hen-testing stations of a number of other countries, for the purpose of ascertaining the laying capacity of hens coming from poultry breeding stations, as well as to relieve the majority of breeders of the trouble of testing their own hens and to ensure their obtaining the best eggs for setting

The scheme is under the strictest State inspection, which covers the number and size of the eggs, their colour, the consumption of feed with the corresponding return, broodiness, moulting, etc

The tests extend over two years and are applied to whole pens, each consisting of a cock, six hens and a reserve The feeding and general care is naturally identical for all the birds Each of the twenty groups on which the tests are being carried out is placed in an isolated wooden fowl-house, provided with trap-nests in three separable parts, an automatic feeder and a drinking trough Alongside of each fowl-house, which is 2.50 metres long, 1.70 metres deep and 1.50 metres high at the back and 2 0 in front, a small covered pen is attached, which is open towards the south and east and has a run of 70 square metres.

The report for the first year states that the poultry very quickly became used to their new conditions and to the automatic feeder and that the hens lay well even in a hard winter and in cold nesting places, if they are hardened and have the opportunity of obtaining the warmth they need in the form of food from the automatic feeder. It appears too that the size of the run is not of so much importance, provided that the hens can find green stuff or insects on it ; on the other hand a small covered shelter is indispensable for the days when the weather prevents fowls remaining long in the open.

The results of the first year showed that no breed is to be singled out as unconditionally the best laying breed and that good and bad characteristics appear sporadically in different individuals of the same breed and are even separately inherited. In every pen there were very good, good and bad layers, and corroboration of this lies in the fact that the rivalry between poultry breeders in Austria is still in its early stage.

It was noticeable that the influence of the weather on the laying capacity was nor marked, a fact which is attributable to the provision of a permanent shelter and to the automatic feeder ; and further that broodiness interferes more than moulting with the laying.

The winning breed of the season 1923-24 was a family of white Leghorns belonging to the Pfannhauser poultry farm at Mitterndorf on the Tischa, which produced 886 eggs. A pen from Sulmtal came second with 861 eggs and a pen of Saxony fowls with 790 third. A pen of Plymouths with 300 eggs stood twentieth, while another family of the same breed came eighth, a good illustration of the diversity among individuals of the same breed.

The performance of each single hen is naturally also tested and furnishes additional evidence that the rate of egg-production is an entirely individual characteristic of the bird, and often varies to a quite extraordinary extent within any one pen.

Each pen was kept under test for a year and then returned to the owner who can then resume breeding.

The mixed feed given in the feeder consists of 10 grammes of dried yeast, 10 grammes of meat-meal, 5 of fish-meal, 30 grammes of wheat-bran, 20 of barley middlings and 4 grammes of charcoal per hen and per day. In addition they are fed rations of 10 grammes of maize, 10 of wheat and 20 of oats, half being given in the morning and half in the evening. The daily consumption on an average is 66.2 grammes from the automatic feeder and 50 grammes of the cornfeed. Besides, the hens daily pecked over about 48.7 grammes of green feed, turnip tops or artichoke.

The feed used was chemically analysed each month. The average content in nutritive material was : 17.05 % albumen, 3.74 % fats, 52.77 % carbohydrates. The nutriment ratio was 1 : 3.6, the number of calories 328, the starch value 77.

The cost of the feed per egg was estimated to be on an average 1438 krone. In the case of individual birds it fluctuated between 1037 and 3328 krone and the usual market price in the middle of the period was 1930 krone.

The aggregate weight of the eggs of all the hens was 13.6 % of the weight of the feed taken. The White Wyandotes could however produce eggs of a weight of 17.4 % of the feed, while the worst pen only accounted for 7.3 %.

The first egg was usually laid on the 286th day. A hen from Alsteirer however laid her first egg on the 116th day.

The first egg usually weighed 2.6 % of the weight of the hen on the day of laying. The average weight of an egg was 57 grammes. Variations occurred in the different pens, taking the whole year, of from 52 to 61 grammes. The white Leghorns that gained the first place produced eggs of an average weight of 56 grammes.

The general interest roused by this establishment is very marked. The monthly reports are regularly published in a number of journals, and the President of the Federation, Dr. Michael Hainisch, was present at the formal opening.

H. K.

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FARM ENGINEERING.

Methods of Cultivation and Machines.

349. New Methods of Cultivating Dry Soils in Spain.

I. — QUINTANILLA G., Director of the "Estación Agronómica Central" and of the "Estación de Agricultura General" at Alcalá de Henares (Madrid); Alfalfa in Beds. Nuevos cultivos de secano en España. *El Progreso Agrícola y Pecuario*, Year XXX, No. 1,340, pp. 249-252, figs 4. Madrid, 1924.

II. — BENAIGES DE ARIS C. (Ing. Agr., Professor at the Escuela Especial de Ingenieros Agrónomos): The Double-Row System. *Boletín mensual de Olivicultura y elaboración moderna del Aceite de oliva*, No. 70, pp. 466-470. Figs. 3. Tortosa (Tarragona), 1924.

III. — *Idem, Idem.*: The Double-Row System and the Application to Olive Plantations. *Idem*, No. 71, pp. 471-476. Figs. 3. *Idem.*

I. — The author had delayed publishing the results of his investigations until they had been confirmed by experiments carried out for several years. In 1917, at the Agricultural Station at Alcalá de Henares, he sowed two plots of 500 sq. m., with alfalfa seed from Aragon (Spain), perfectly hulled and of high germinative power, in double beds each 30 cm. wide, each pair being separed in one plot by a distance of 80 cm. (Plate XLVIII, fig. 98), and in the other by a distance of 120 cm. (Plate XLIX, fig. 99). In the spaces between the beds the soil was tilled by a small one-horse plough during the different stages of growth, in order to preserve the soil moisture. This was the first trial of the sort made in Spain, and the unfavourable conditions led the author to expect that it would be a failure. The soil in which the trial was made is rich in phosphorus and potash, poor in lime in the top layer, of average content in the middle and rich in the lower layer, and all three layers were poor in nitrogen, this scarcity increasing with the depth. The average annual rainfall registered at the Station Observatory is 367.5 mm., this figure being obtained by finding the average precipitations for the years 1917 to 1923, during which the tests were made. The results are given in the following table:

From the above data and other data relating to the price of labour, fertilisers, etc., the author gives a detailed account of the expenditure and profit accruing from the cultivation of alfalfa, with the result that an annual profit is shown per ha. of 354.79 pesetas in the case of cultivation in beds separated by a distance of 0.80 m. and of 343.60 for beds separated by a distance of 1.20 m. Although the difference is very small these results are of economic importance. From the annual precipitations utilised by the alfalfa for growth, it is deduced that each unit of dry matter produced corresponds to 1,591.70 units of water. Bearing in mind the nature of the soil, transpiration, evaporation, etc., it follows that, to produce one unit of dry matter the alfalfa will require $^2/_3$ of 1591 or 1061 units.

PLATE XLVIII.

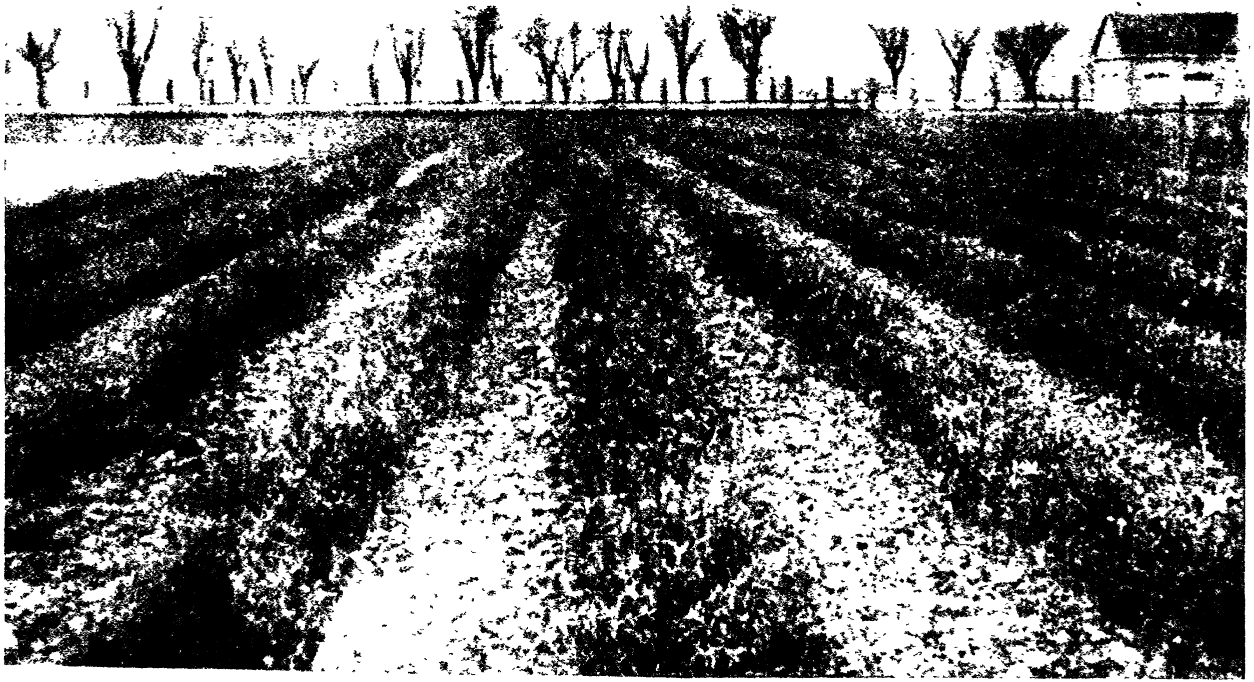

FIG. 98. — Alfalfa cultivated on dry soil, at the General Agricultural Station at Alcalá de Henares (Madrid). Beds of 0.30 m. in width. Distance between beds 0.80 m.

PLATE XLIX.

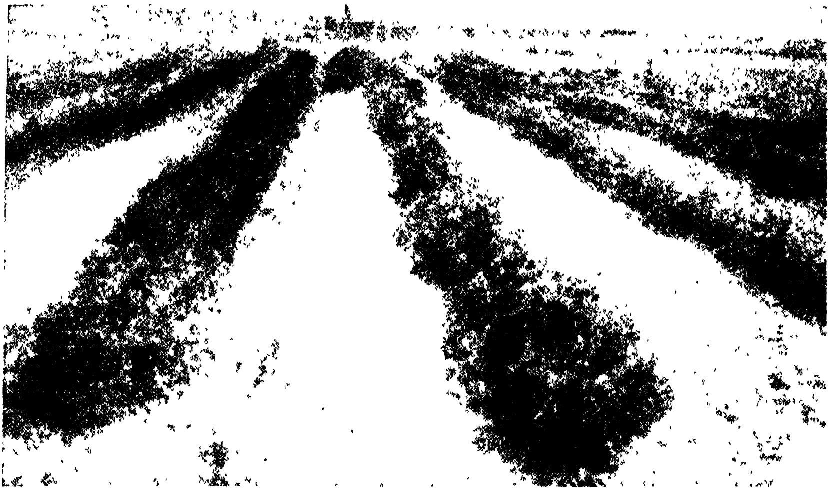

FIG. 99 — Alfalfa cultivated on dry soil, at the Central Agricultural Station at Alcalá de Henares (Madrid).

Beds of 0.30 m in width. Distance between beds 1.20 m

FIG. 100 — Crop of wheat obtained on dry soil, after leguminous crop, without fallowing. by the "double-row system"

The extraordinary development of the ears and high grain yield show the advantages of the system, wich is based on a suitable crop rotation, deep cultivation in autumn, frequent and thorough surface tillage of the beds between the double rows. In spite of leaf growth, the passages of 42 cm. in width were not closed in, thus allowing during the whole period, the use of the small cultivator and the effective action of air and light.

FIG. 101 – The "double-row system" applied to cereal crops

The ploughing, breaking down and cleaning of the passages of 40 to 50 cm wide left between the beds of double rows sown, and the light earthing up of the plants, increases the yield and preserves soil humidity

The ventilation of the top layer of the soil stimulates nitrification, oxidisation, the formation of soil substances and the liberation of the soil reserves

FIG. 102 Single furrow plough for the "double-row system" small pattern, drawn by one small animal fitted with extensible knives for cutting weeds between the plots, hand-weeding being thus dispensed with Fitted with other appliances for breaking down the soil and earthing up the plants

According to the nature of the soil, from 1 to 1 $^1_2$ hectares can be ploughed in one day, with only one small draught animal and a boy driver.

Results obtained by " Bed " Cultivation 1917-1923.

Year	No. of cuttings	Yield of dry alfalfa per ha.	
		Distance 0.80 m.	Distance 1.20 m.
		Kg.	Kg.
1917.	1	460	420
1918.	2	1,040	1,220
1919.	3	3,480	3,280
1920.	4	4,220	3,900
1921.	4	3,700	3,580
1922.	5	3,050	3,070
1923.	3	2,400	2,400
	Average yield	2,621.430	2,554.85

The yield of dry alfalfa, with an average rainfall of 377.5 mm., in the open field, the soil depth of which varies from 70 cm. and upwards, will vary between the limits of 2,621 and 3,933 kg., *on condition that it be sown in beds and that the intervening spaces be constantly cultivated after the rains, and on the appearance of weeds.*

The author then states the advantages which would follow from a general adoption of this system by stock-breeders and farmers, whom he urges to make a trial of the method by which is avoided the cultivating land one year and allowing it to lie fallow the next. The expense with this system is only 172 pesetas, whereas for ordinary cereal cultivation at least 450 pesetas of working capital are required.

II. The author describes the two great difficulties which Spanish agriculture has to contend with: (1) The low rainfall and its unequal distribution ; (2) the absence of humus in the soil, and the impossibility of increasing it by the addition of manure, owing to the insufficient quantity produced by the Spanish cattle. The author alludes to the WITDSOE method and to gives some of the results obtained from the experimental plots on the farm at Valladolid, by the application of the " double-row system " (Plate XLIX, fig. 100 and Plate L, fig. 101). The yields were, from a dry plot : 1st year: 4,513 kg. of wheat (dry crop) ; 2nd year: 3,610 kg. of vetch, cut and made into hay; 3rd year: 8,150 kg. of wheat after the vetch was cut ; and 4th year: 3,700 kg. of spring peas. The average yield for the four years was 5,000 kg. of dry matter per hectare.

The wheat was sown on the " double row system ", in groups of two rows with a distance of 13 cm. between each, and each group separated from its neighbour by a path of 42 cm., to enable the necessary tillage to be done. The vetch, being cut green, is grown thickly in equidistant rows, mixed with 10 % of oats, which serve as a support.

The chief advantage of the system is that the numerous light cultivations given to the soil, in order to avoid caking of the surface, and to preserve the soil moisture and destroy weeds, can, by means of the intervening spaces be carried out with the single-furrow light plough patented by the author (Plate L, fig. 102) which is economical owing to the light draught and low wages of the driver.

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The water supplied by the rains is less than that necessary to obtain the dry matter produced in the crop, but the deficit is made up by the "atmospheric moisture" or dew. Through the repeated tilling, in the "double-row system", the water received by the plots from the atmosphere at the end of the year is of importance, as is shown by DEMSCHINKY'S, GLOVINSKY'S and KOSTYTCHEFF'S tests. The results of these tests are apparently not in agreement with those of American experimenters, if it be not taken into account that transpiration and absorption are in inverse ratio to the concentration of soil moisture, which concentration may be modified by the fertilisrs. Also QUINTANILLA at the Central Agricultural Station has found the considerable reserve of water retained by surface cultivation, which reserve, in soils 1 metre deep, may be as much as 280,000 litres.

The scarcity of organic matter is overcome by introducing a legume in the crop rotation, which may be sometime dug in, as is done in the rice zone of Valencia, with broad beans, and more often by cutting the legume grown and making it into hay. By this method 3,450 kg. of wheat per hectare and sometimes still larger yields, have been obtained on dry soils. The author cites other results obtained by various cultivators in Castille, hence it is not a question of experimental trials only, since they have been obtained over areas of 160 ha., on shallow, poor, dry soil, and on areas 40 ha. in the case of gravelly soil.

III. — The author recalls the advantages of "dry farming" tillage, and cites some tests made by TULL, SCHLOESING, DUMINT and DÉHÉRIN, and shows that the system of "double-row" cultivation sufficiently supplies crop requirements in climates having an exceedingly low rainfall.

This method has also been tried on the "Colmenares" estate (a suburb of Malaga), planted with olives at intervals of 12 m. The soil, is clayey, hard, dry and of medium quality. Only the central spaces and the passages between were sown, the parts under the trees being left (6 ha.) free. Although the trial was made on a comparatively large area 220 kg. more of wheat were obtained on this olive plantation than on the nearest wheat fields. The author gives details relating to this trial and recommends a cereal and legume rotation, digging in lime for the cereals and suitably fertilising the legumes, and considers that both yields and soil fertility will be thus improved. E. M. F.

350. Rice Growing Without Transplanting.

JOSHI, F. G. (Superintendent, Ganeshkhund Gardens, Kirkee). *The Agric. Journal of India*, Vol. XIX, Part II, pp. 160-163, figs. 2. Calcutta and London, 1924.

The transplanting of rice is the most costly operation in the production of the crop, but has hitherto been considered necessary.

The author has carried out experiments for five years in which the seed was sown directly in the field, being spaced by means of a field marker, in order to assist weeding.

The marker consists of a wooden roller about 12 inches in diameter, in which holes are made to take pointed pegs 7 inches in length; these pegs are set at regular intervals in 4 rows along the roller, which may be 6 feet or more in length. The implement is rolled along and leaves holes in the soil for the seeds. This simple implement is quick and accurate.

The land is ploughed after the previous rice crop and is reploughed in preparation for sowing, which is done in May or June. When the lines of plants become visible, the field is weeded by means of a simple modern implement, like a very light plough. When the water is in the field the weeder is again used to stir the land. The plants are thinned where necessary and those removed are used to fill any gaps.

The author carried out experiments at two centres and in cultivators' fields actual records showed th it this method of growing rice without transplanting does not lower the yield, and reduces the cost of growing by about 50 %. W. S. G.

351. Introduction of Milking Machines into Austria.

DEIBL (Farm-manager). Melkmaschinen mit elektrischem Antrieb. *Wiener landwirtschaftliche Zeitung*, No. 69, one page, 30. August 1924.

GUTSCHMIDT (Dairy-manager in Aschbach) Die Melkmaschine und ihre Vorteile für die Milchwirtschaft. *Milchwirtschaftliche Zeitschrift*, Part 3, 2 pages, 2 illustrations, 5 February 1925, Year 32, Vienna.

The author describes the first experiments made in Austria with the Alfa milking machine, driven by electric power. The following are the conclusions reached:

1. Machine-extracted milk is cleaner than hand-drawn and its hygienic condition is better, more particularly as there is no chance of the admixture of dirty milk.

2. Cows do not in any way resent the use of the machine-milker. They stand quiet and continue to chew the cud during the operation.

3. Milking by machine takes somewhat longer than hand-milking, but on the other hand there is a perceptible lightening of the labour involved.

4. Hand milking is better in so far as the work of milking is in that case always an individual operation, in which account is taken of the special disposition and habits of each cow. It depends for its success however on a thoroughly capable well trained staff of milkers. Where such a staff exists the introduction of milking machines is not to be recommended.

5. On farms where the milkers are only partly trained or completely untrained, or changes are constantly being made, and care is taken that the separate parts of the machines are kept scrupulously clean and thoroughly disinfected, the introduction of milking machines is to be recommended. H. K.

RURAL ECONOMICS.

352. Estate Accountancy.

DUNLOP, Prof. W. R. (Professor of Economics, Imperial College of Tropical Agriculture, Trinidad). *Tropical Agriculture*, Vol. I, No. 4, pp. 58-62 ; No. 5, pp. 74-78 ; No. 6, pp. 90-92 ; No. 7, pp. 106-110 ; No. 8, pp. 122-125. Trinidad, 1924.

The author draws attention to the lack of systematic and scientific study in relation to accountancy and the actual management of estates. In a series of articles is given a description of scientific accountancy in its application to tropical estates and their administration, the principles and methods being explained in detail.

A long series of very important questions is asked respecting a sugar estate, to answer which necessitates a continuous and uniform costing and statistical system, based upon sound principles.

Accountancy may be divided into three sections: — (*a*) Financial; (*b*) Cost ; (*c*) Statistical, although in practice the three classes are inseparable in a properly managed industry.

In the second article, the author considers the form of a Balance Sheet for a large estate, a medium and a small estate and explains the method of double-entry and the distinction which should be drawn between cash, capital and other conceptions underlying financial administration and management of tropical estates. Examples are given of Balance Sheets and various accounts.

The principles of valuation are considered before dealing with cost and value. The value of an estate to a purchaser is its cost to him ; when placed on the market the price obtained is the market, or selling value which is the cost value to the new purchaser. The initial cost remains a fixed value, but the owner must know how his capital is apportioned in order to ascertain in what proportion each department is responsible for interest on capital.

In a new estate it is usual to take this cost as a basis of value in the first instance ; later on, however, some owners adjust cost to market value. This is wrong, *e. g.*, on a coconut estate the value of each field includes cost of land, clearing, planting and bringing the trees up to the point of productivity. At this point current expenditure on the trees begins, and the estate becomes a going concern. Improvement in yield of the trees increases the value of the estate, but does not increase its cost. Allowance is made for depreciation and additional capital expenditure incurred from time to time.

In drawing up a " statement of affairs " of a new estate, values are assigned to the various assets, the percentage of each is calculated and the percentage figures used to divide proportionately the actual cost price.

It is not desirable to include interest on capital, but to record merely the bare cost.

Estates are generally capitalised when placed on the market, taking as a basis the average profit over a number of years.

It is essential to divide up an estate into sections, as different sections will have different costs and revenue earning values. Since the soil and plant are biologically connected, it is convenient to consider each unit of soil and plant as a single biological factor.

As regards machinery and buildings, cost valuation for the different items in each class should be kept separate, *e. g.* labourers' cottages, overseer's and manager's house and the main machinery units.

With reference to live stock: in the case of working-cattle in the tropics, calves at birth are considered as of no value in cost accountancy. In a dairy herd they are a by-product and have no value, other than the cost of rearing, whereas, in a breeding herd the cost value of the calves at birth is the cost of maintaining the herd.

Depreciation is the difference between original cost and residual value; the rate of depreciation should be placed too high rather than too low. The determination of the rate requires a decision as to the effective life of an asset. On estates there are at least four special cases for consideration: buildings, machinery, trees, crop-ratoons. If a tree is killed the valuation of that section must be reduced by the amount the dead tree cost, less its depreciation to date. In the case of sugar cane ratoons, if the plant-cane crop is made to pay all expenses, then the ratoons have no value. But the original cost of establishing the field of plant-canes can be regarded as capital expenditure, and if the crop yields for five years then the annual depreciation will be $^1/_5$ of the capital.

In the fourth article of the series the author deals with the principles and practice of Financial Costing, which are generally applicable to an estate, although the examples given have reference to coconut production, and specimen accounts of a coconut plantation are given.

An annual statement is drawn up of the various accounts, and the value of the system is that a summarised statement of the working and financial position of an estate is provided for each year. The convenience and value of graphic records is illustrated by a part of a chart (fig. 103) kept by a sugar plantation, which shows the days on which subsoil ploughing was done, the acreage and costs.

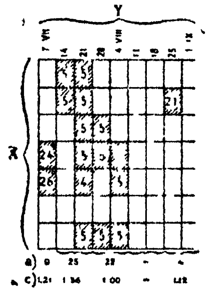

FIG 103.

y = days in the week,
x = 4 weeks in the year

Cost-records and finance are discussed. In the usual system of bookkeeping, wages, staff expenditure and purchases of materials for immediate consumption are recorded in lump sums. The author advises more detailed records, the selection of accounts and the debit of each with the individual costs, so that a curve can be plotted of costs throughout the crop financial year. However, accountancy can be carried to an extreme, but it is well to distinguish between capital and current expenditure.

Many managers of tropical estates keep records of whàt each labourer does each day ; of stores bought and consumed ; yields of different fields ; factory costs ; rainfall statistics.

The author gives specimens of headings of the forms and account books recommended, including graphic records.

W. S. G.

AGRICULTURAL INDUSTRIES.

Plant Products.

353. Progress in Home Brandy Distilling in Lower Austria.

LÖSCHNIG (Expert Adviser for Wine-making to the Lower Austrian Chamber of Agriculture). Landwirtschaftliche Beispielsbrennereien der n. ö Landeslandwirtschaftskammer. *Die Landwirtschaft,* Part 1, pp 2, illustrations 2. 15 January 1925, Vienna

With a view to encouraging the systematic economic utilization of all kinds of fruit, and particularly of unmarketable produce such as small cracked plums, a brandy still has been invented by Herr LÖSCHNIG Inspector of Fruit-growing, who has a high reputation for his work in improving fruit cultivation. This type of boiler differs in manny respects from similar apparatus, effects a great saving in work and results in a product of relatively greater value. The provincial Chamber of Agriculture have instituted short courses of one or two days' instruction in the proper use of this apparatus, and in 1924 nearly 2000 farmers took advantage of these courses in distilling.

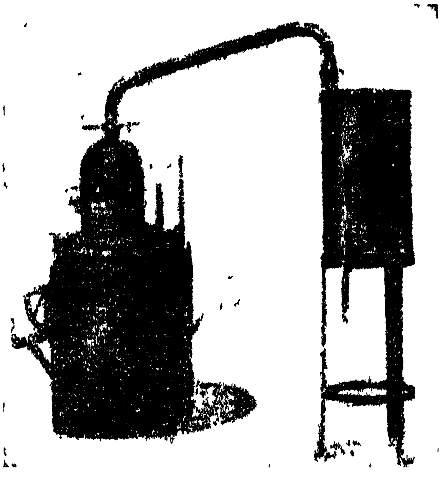

FIG. 104. — LÖSCHNIG's distillation boiler.

In the distilleries on the 'LÖSCHNIG system' the boilers are so constructed that the contents can be tipped out and the emptying is thus done quickly. The walls of the boiler and the head are cylindrical and vertical, but in order to secure rapid boiling the vessels are broad and shallow. The base is curved inwards so as get the full benefit of the fire, and there is a drainer which rests on the floor of the boiler, for the purpose of preventing the thicker portions of the mash from coming in contact with the hot metal and thus burning. As only the more liquid part of the mash comes into contact with the heated surfaces no stirring is required. The head is large and set somewhat to the side instead of in the middle so as to make it easier to pour the mash into the boiler. At the point where the connecting pipe leading to the condenser is joined to the head an intercalated tin condenser is fixed, which condenses the fusel oil vapour and thus prevents it from passing into the condenser.

Similarly to prevent the passage of the fusel oil into the condenser, the connecting pipe is so arranged as to pass at a level higher than the condenser. Particles of fusel oil in a state of condensation thus fall back into the boiler. The condenser is amply proportioned so as to be large enough for all requirements. At the outlet an instrument for determining the specific weight of the brandy is placed, so that it may always be possible to test the strength of the distilled liquor. The condenser is designed on the principle of the countercurrent refrigerator and the boiler is fitted with a thermometer.

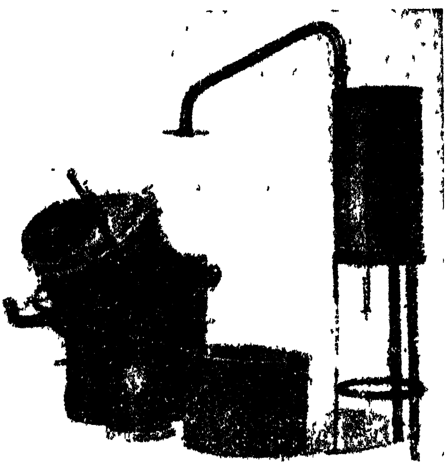

FIG. 105. — LÖSCHNIG'S distillation boiler.

H. K.

354. The Olive Industry in Southern Europe.

I. CRUESS, W. V. (*University of California, College of Agriculture Circular No.* 278) Olive Pickling in Mediterranean Coutries. pp. 33, figs. 19, bibliography, Berkeley, Cal., 1924.

II. CRUESS, W. V. Preparation and Refining of Olive Oil in Southern Europe. *Ibidem, Circular* 279. pp. 43, figs. 24, bibliography, Berkeley, Cal., 1924.

These publications have been prepared from information obtained and observations made by the author on a recent visit to the olive producing and refining centres of Italy, France and Spain.

The first Bulletin discusses cultural methods, the olive fly, varieties of olives suitable for picking, the French and Greek methods of pickling, and concludes with a description of a simple process for drying olives.

The second Bulletin gives detailed accounts of the olive oil industry, viz., statistics as to the total acreage in Italy, France, Spain, Greece, Portugal, Algeria and Tunis; picking and transport; crushing and pressing equipment and methods followed in the various countries, illustrations and diagrams being given of the plant; by-products, such as pomace, black liquor and settlings from the oil storage tanks; methods of refining; oil standards; packing for transport. W. S. G.

355. Tambookie Grass for Paper Making.

ENGLISH, E. F. *South African Journal of Industries*; Vol. VII, No. II, pp. 745-752 figs. 8. Pretoria, 1924.

Amongst the South African raw materials suitable for paper making, tambookie grass (*Hyperhenice glauca* Stent) has been prominent.

An analysis of the oven-dried whole grass gave: cellulose 56-7 %, ash in cellulose 0.95 %, ash in grass 6.04 %.

The grass was pulped on a laboratory scale under the best conditions and gave a yield of 46-47 %, dry pulp on dry grass. The pulp produced is light in colour and can be bleached with less than 10 % of bleach The yield of bleached pulp under the best conditions was 44-45 %, which compares favourably with that from Spanish Esparto and is higher than that from Algerian Esparto. W. S. G.

356. The Drying of Rubber; Influence of various Factors in its Preparation; Tests of Methods of treating the Coagulant.

DE VRIES, O Onderzoekingen over de opdroginssnelheid van rubber I Invloed van verschillende bereidingsfactoren, proeven over verschillende voor behandelingen van het coagulum *Archief voor de Rubbercultuure*, Year VII, No. 3, pp. 95-123 Buitenzorg, 1923

It is well known that the rate of drying of rubber is very variable; the following are data relating to the principal cases presented:

(1) If the recently rolled coagulant be steeped in a solution of 1 % caustic soda, the rate of drying degree is increased, but this treatment has a deleterious effect on the quality of the rubber, causing stickiness.

(2) If rolled in the afternoon, after coagulation, the rubber dries more quickly than that which is rolled the next day.

(3) Soaking in water delays drying, in sheet rubber the drying period is increased from 2 to 4 days to as much as 2-3 weeks.

(4) The thickness of the "crêpe" sheets influences the drying period. The rate of drying is also influenced when the rubber is rolled too tightly; the internal portion remains moist so long that "slowly-drying rubber" is formed, which may take weeks to dry. In practice, the thick edges and corners of the sheets, which remain white and opaque while the remainder of the sheet is completely dry, are simply cut away and kneaded up or sold as remnants.

(5) Pressure greatly retards drying. In the author's tests, on extracting the moisture by great hydraulic pressure, a coagulant with 15 % of moisture is obtained which loses no further moisture in the air.

(6) The coagulant, which during this operation has been heavily pressed and heated, dries very slowly (7 weeks, instead of 6-10 days).

(7) Spontaneous coagulation produces a "crêpe" which dries somewhat more slowly than that obtained by coagulating with acetic acid.

(8) By keeping the coagulant some time before pressing, and especially before maturing, slowly-drying rubber is produced. All the types of rubber which contain a certain quantity of moisture (sheet rubber, smoked lumps) give a slowly-drying "crêpe"; in the same conditions in which an ordinary "crêpe" dries in a week, a sheet "crêpe" dries in 15-25 days and a smoked lump "crêpe" (Java Para) in 15 days.

(9) Coagulating with alcohol increases the drying period by 25 %.

(10) Coagulating by heating the latex gives a slowly-drying rubber. The drying period for "crêpe" was 13-16 days, while that of the check was 4-6 days.

(11) By adding sulphide or bisulphide of sodium to the latex, drying is slightly retarded. With "crêpe" the difference is small and seldom more than 1 or 2 days; with sheet rubber, if care has not been taken to avoid the use of too large doses of these chemical compounds, the drying period is increased by some days.

(12) Coagulating with sulphuric acid produces rubber which dries more slowly; it was proved that the presence of sulphuric acid was the cause of the increase of the drying period, as is the case with sulphide or bisulphide.

(13) It was found that sodium acetate, which was supposed, on account of its hygroscopicity, to be the cause of slower drying, as also the addition of salts of sodium to the latex, does not influence the drying period. Even in excessive quantities it does not exert much influence.

(14) Coagulating with sodium chloride, or the use of salt-water or sea-water for diluting the latex produces a very slowly-drying rubber.

(15) Alum, or water containing this coagulant, may also be the cause of slow drying. Alum may cause a delay of from 13 to 41 days.

The author has made a series of tests on the influence of the various treatments of the coagulant and has also made investigations to ascertain whether there is any connection between the rate of drying and the hygroscopicity of the rubber. The results of these tests are summarised below:

Moisture may be reduced by keeping the recently rolled sheet in alcohol or in diluted formalin (1 : 10 or 1 : 100). Keeping it in a 10 % solution of acetic or a 5 % solution of alum slightly reduces the drying period, but this may be partially or totally caused by the loss in weight by contraction when the coagulant is kept in these solutions.

The length of time that rubber is kept in water increases the drying period from 4 to 6 or 10 days, 3 days' steeping causes an extension of the drying period of from 5 to 11, or from 4 to 18 days, and a weeks' soaking gives a very slowly-drying rubber; sheets of ordinary thickness take 1 ½-2 months to dry in the air.

The degree of dryness is slightly decreased by keeping the rubber in 1 % acetic acid, 5 % sulphide or bisulphide of sodium, 1 % chinosol, and

9 % caustic soda. By keeping the recently rolled coagulant in a moist atmosphere over water the drying rate is retarded. By keeping it over serum dryness may be increased or decreased; an atmosphere of coal gas or carbonic anhydride increases dryness; keeping in a closed bottle (in which the oxygen is soon absorbed) gives contradictory results, on which further investigation is necessary. By adding formalin to the latex, drying is not delayed to such an extent. The coagulant formed from very diluted latex may dry as quickly as ordinary coagulant. The coagulant drying slowly through being kept in water may dry quickly by being afterwards treated with alcohol. Subsequent treatment in formalin (1 : 10), 10 % acetic acid, 5 % alum, has little or no effect. A coagulant which dries more quickly by being kept in formalin (1 : 10) or alcohol, dries more slowly after a subsequent treatment with water, but not so slowly as fresh coagulant treated with water. Thus, an air-dried sheet dries slowly if it has been kept a certain time under water.

During treatment (keeping in different solutions or in a bottle) the coagulant loses 10-15 % in weight, the greater part owing to contraction, a small part through the expulsion of serous matter.

Micro-organisms take no part in the production of slowly-drying coagulant; this phenomenon always takes place in the same manner under conditions in which the action of micro-organisms is absolutely excluded (disinfection by boiling, treatment with alcohol, or formalin).

The hygroscopicity of rubber (its content of hygroscopic serous matter or hygroscopic matter formed during its preparation) influences the moisture content of air-dried rubber, but has no appreciable influence on the degree of dryness and is not the determining cause of slowly-drying rubber. Rubber which dries more slowly is obtained by treating for a long period in water, by which treatment the hygroscopic matter is to a great extent driven off.

The causes of the slow-drying phenomenon must be in the structural changes of the coagulant, or, more exactly, slow-drying is not due to the formation of an impervious surface layer, but to a structural change of the whole mass. F. C.

357. Experimental Timber Preservation in South Africa.

STEPHENS, H. B. (Forest Department) *South African Journal of Industries*. Vol. VI, No. 10, pp. 650-656, and *Ibidem*, No. 11, pp 736-744, plates 10. Pretoria, 1914.

In the first article the author discusses the need for timber preservation, the agencies destructive to timber, preparations and methods of preservation, and describes the plant at the Experimental Timber Preservative Station, Pretoria.

The article shows the increased service yielded by treated timbers and the importance of tests, and describes the open tank and pressure treatments and the effects of strength of solution and wood structure on absorption. The costs of treatment are discussed and a description is given of special experiments for the control of boring beetles, white ants, fire, and the preservation of mining timbers and railway sleepers. W. S. G.

Animal Products.

358. Measurement of Hydrion Concentration in Dairy Products with Billmann's Quinhydrone Electrode.

LESTER V. (University Institute of Hygiene, Copenhagen). *Journal of Agricultural Science*, Vol. XIV, Part 4, pp. 634-641, figs. 3, tables 6, bibliography. London, 1924.

The estimation of the hydrion concentration of milk, cream, whey and buttermilk has hitherto presented technical difficulties, and has been open to error, largely owing to the time taken, during which the reaction of the milk or other liquid changes.

The results of a series of experiments on the hydrion concentration of various dairy products, in which BIILMANN'S Quinhydrone Electrode and HOBER-HASSELBLACH'S Hydrogen Electrode were employed, were as under:

The results of the tests agreed, no difference being found in the reaction or buffer action of fresh or heated milk. The HOBER-HASSELBLACH method is slow, in consequence of which there is risk of the reaction of the liquid changing during the test. Also there is risk of too high *p*H values owing to loss of CO_2. BIILMANN'S Quinhydrone Electrode is quick, easy and simple and avoids the above sources of error. It is especially well adapted for titrations, as it allows of a large number of estimations being carried out in a short time.

Details of experiments are given in the article. W. S. G.

359. *Oidium variicolor*, a New Mould in Milk and Milk Products.

PROKS, J. (Lactological Institute of the Czech Polytechnical School, Prague) *Le Lait*, Year 4, Vol IV, No. 38, pp. 640-643. Lyons, 1924.

The coloured varieties of *Oidium* mould found in milk and milk products are: *Oidium aurantiacum* (brick red), *Oidium rubrum* (blood-red) and blue lactic *Oidium*.

During the bacteriological analysis of a defective butter, the author isolated a mould of the *Oidium* species which differs remarkably in its colouring properties from the moulds of this species hitherto described.

When cultivated on white curd cheese, the mould reveals the following under the microscope: the mycelium forms arborescent filaments of a violet tinge. As soon as the mould matures, the filaments develop typical oidia at the extremities: they are either rectangular or oval. The formation of oidia is very abundant; they have a faint violet tinge. The contents of the cells of the filaments and oidia are easily coloured by carbol fuchsin; the membranes are difficult to colour, for they are thick and strongly refract light rays.

The author then gives the development characteristics of the mould in the different nutrient mediums; observation shows that the mould changes colour during growth: violet-pink, violet and then blue.

The *Oidium variicolor* shows poor development on acid or alkaline nutrient mediums, but thrives better on neutral or very slightly acid nutrient mediums; in this it differs from the *Oidium lactis*, which develops badly on neutral or alkaline nutrient mediums and only grows on slightly acid nutrient mediums.

In spite of the abundant formation of oidia and their easy separation, this mould is found very rarely. P. D.

360. The Freezing Point of Sudan Milk.

JOSEPH, A F & MARTIN, F J. *The Analyst*, Vol XLIX, No. 682, pp. 240-423, bibl Cambridge, 1924.

The authors have made a cryoscopic examination of cow's milk from tropical countries. This milk is generally richer in fat and total solids minus fat than that of countries with a temperate climate For this test the authors used 51 animals belonging to three different races: Damietta, cross-bred Shorthorn and a native breed from the Khartum district. Their researches led to the following conclusions as regards the freezing point:

(1) The freezing point of the Sudan cow's milk is practically the same as that of cow's milk from the United States.

(2) The " race " factor has scarcely any bearing regards the freezing point.

(3) Different portions of the same milking have the same freezing point.

(4) The lactation period has only a very slight influence on the freezing point.

(5) The freezing point of goat's and ewe's milk is lower than that of cow's milk, while that of ass s and cow's milk is the same

(6) Abnormal results, due to the rapid development of acidity in warm climates, may be avoided by the use of chloride of mercury at 1 : 2000. P. D.

361. Reducing and Oxydising Reactions in Milk.

HAAS, P and LEE, B. (Botanical Department of University College London), Further Observations on Certain Reducing and Oxidising Reactions in Milk *The Biochemical Journal*, Vol XVIII, Nos. 3-4, pp 614-620, 1 figs. Cambridge, 1924.

One of the authors in collaboration with HILL had observed in milk the presence of a substance with oxidising reactions similar to those of peroxydase, which it may be regarded as resembling. To this substance the name of " istase " was given. Further experiments, however, show that " istase " and peroxidase, although both possessing the properties of being inactive under boiling and of remaining in the serum, are not identical and can even be separated.

In oxidation of the nitrites by the milk, in the presence of acetaldehyde and oxygen the function of the istase is to produce a peroxide of the aldehyde: from that point of view, it may be compared with the supposed oxygenase of the oxidase of plants.

The oxidation of the nitrites accordingly results from the combined action of the peroxide thus formed and from the peroxidase and not from the action of the istase by itself. A solution containing istase and peroxidase, but not peroxide, does not oxidise nitrites, whereas nitrites are oxidised by a solution containing peroxidase, but not istase, when oxygenated water is added to it. A. F.

362. Cause and Prevention of Disagreeable Flavours of Butter.

GIBSON, A. L (Professor of Dairy Chemistry, Ontario Agricultural College, Guelph). The Chemistry of some Butter Defects. *Scientific Agriculture*, Vol. 5, No. 2, pp 57-61. Ottawa, Ontario, 1924.

The author has ascertained that the tallowy flavour of butter is due to oxidation, which oxidises not only olein, but also the glycerol produced by hydrolysis of the fatty matter.

The oxidation of glycerol produces glycolic acid.

It should be stated that:

(1) exposing cream and butter to the simultaneous action of the air, light and a high temperature, favours oxidation;

(2) lactose in a neutral or slightly alkaline medium is highly favorable to oxidation;

(3) butter made under good conditions, with fresh cream at a reasonable degree of acidity, cannot acquire the tallowy flavour through the presence of lactose, as lactic acid acts as a slight preservative;

(4) copper and its alloys, bronze and nickel, as also the salts of these metals acting on butter in consequence of the excess of acidity in the cream, act as catalytic agents of oxidation. Iron and its compounds favour oxidation in the same way, but their action is weaker;

(5) abnormal alkalinity of cream or butter increases the oxidation;

(6) casein, in combination with copper and its salts, but not alone, facilitates the production of the tallowy flavour and is the cause of the pink or brownish colour in the last stages of development.

The most generally accepted opinion at present is that a fishy flavour is caused by trimethylamine, the basal substance of which is lecithin. Through partial hydrolysis lecithin gives choline, the oxidation of which forms trimethylamine.

The conditions which favour or give rise to a fishy flavour of butter are:

(1) high acidity of the cream;

(2) high salt content of butter; salt intensifies the flavours and increases the solubility of lecithin;

(3) excessive churning of the butter, which increases the air content of the butter ;

(4) the presence of salts of iron and copper which act as catalysers in the oxidation of the choline.

Butter made with pasteurised cream does not so quickly assume the fishy flavour ; pasteurisation causes lecithin to absorb oxygen, and lecithin become less soluble ; pasteurisation causes a partial hydrolysis of the lecithin and the formation of soluble substances in the buttermilk, consequently the lecithin content of butter made with pasteurised cream is too slight to bring about the formation of a sufficient quantity of trimethylamine to produce a fishy flavour.

The preventive measures against these flavours, which depreciate the market price of butter are:

(1) the use of fresh cream in making butter ;

(2) the avoidance of completing the process of manufacture by using chemical or other substances; neutralisers are useless if fresh cream is used ;

(3) the pasteurisation of the cream, and if it is desired to obtain a certain degree of acidity, treatment with pure cultures ;

(4) care not to bring the cream into contact with badly-tinned or copper receptacles ;

(5) the avoidance of excessive salting;

(6) the avoidance of excessive churning ;

(7) the utmost cleanliness. P. D.

363. **Cheese Control Experiments.**

I. IBSEN, CHR. H Ostekontrolforsog. 115*te Beretning fra Forsøjskoles Laboratorium for Landøkonomiske Forsøg* No. 115, pp. 1-25, tables 8. Copenhagen, 1924.

II. ANDERSEN, A. C. and WINTHER, J. E. Om Bestemmelse af Fedt og Torstosi Ost. *Ibidem*, pp. 26-66, tables 3, bibliography Copenhagen, 1924.

I. At a meeting of the Government Agricultural Committee held in the spring of 1921 it was decided that the Experimental Laboratory should carry out experiments on curd production in order to obtain data relative to the fat-content and compounds present in milk which are essential for cheese-making, so that cheese-producers may have confidence in the fat-content minimum as stipulated in the publication of the Ministry of Agriculture of June, 2, 1921. Experiments were made at 8 dairies, extending over 2-3 days in the case of each of the 4 kinds of cheese (45-30-20-10 per cent. fat in dry matter), and on the basis of the data obtained it was decided to publish a table as a *provisional report* from the Experimental Laboratory. At the same time it was resolved that the Laboratory should repeat and check the experiments under practical conditions, for a year.

In order to explain the figures contained in the provisional table, a brief abstract is given below from data relative to cheese having a fat content of 45 % in dry matter.

TABLE I. — *Fat content and constituents of Milk for Cheese Making.* 45 % *fat in dry matter,* 30 % *fat in dry matter per* 1000 *kg. of milk for cheese-making.*

fat in whole milk	protein in whole milk	fat in milk for cheese making	whole milk	skim milk	butter milk
%	%	%	kg.	kg.	kg.
4.00	3.38	3 07	761	219	20
3.90	3.33	3.03	770	210	20
3.80	3.28	2.99	781	199	20
—	—	—	—	—	—
—	—	—	—	—	—
3.00	2.88	2 69	893	87	20

The above data show for each of the 4 types of cheese (*a*) the percentage of fat and protein for whole-milk intended for curd-making, (*b*) the percentage of fat required in ready-mixed milk for cheese making, and (*c*) the amounts of these constituents which should be present per kg. of whole-milk, skim-milk and butter-milk. It may be noticed that the figures for the fat content of whole-milk vary from 4.0-3 % fat, below which limits the milk from Danish cows very seldom falls.

In the course of a year 105 experiments on curd-making were carried out at 44 dairies in the country, to ascertain whether the figures given in the provisional report were sufficiently trustworthy for the practical work of the dairies Amongst the various types of cheese the following number of curd tests were carried out :

45 %	fat	in	dry matter	15	tests
30 %	»	»	»	40	»
20 %	»	»	»	34	»
10 %	»	»	»	16	»

From data resulting from the above experiments the figures given in Table II were calculated

TABLE II. — *Fat content of milk for cheese-making.*

Fat content of whole-milk	Fat content of Milk			10 % fat in dry matter	
	45 % fat in dry matter	30 % fat in dry matter	20 % fat in dry matter	fat content of milk	When whole milk is added
4.00	3.10	1.65	1.00	0.50	10.0
3.90	3 05	1.65	1 00	0.49	10.1
3.80	3.05	1.60	0 95	0.49	10.2
3.70	3.00	1.60	0 95	0.48	10 3
3.60	2.95	1.55	0 90	0 47	10.4
3.50	2.95	1.55	0.90	0.47	10.5
3.40	2.90	1.50	0.90	0.46	10.7
3.30	2.85	1.45	0.85	0.45	10.8
3.20	2.85	1.45	0.85	0.45	10.9

It has been suggested that in Table I it would be better to omit all reference to protein and to give only the fat percentage required in the milk.

This suggestion has been taken into consideration in compiling Table II, which gives the fat content of milk necessary under ordinary circumstances for cheese production. The percentage of fat in dry matter does not fall below the stipulated minimum, but allowance must be made in such cases where the quantity of protein is exceptionally large, and where unusual methods of curd-making are employed, or where Jersey milk is added. Furthermore, it must be taken into consideration that cheeses are not always homogeneous. *With these reservations the Laboratory recommends Table II.* As to the three first types of cheese only the fat content required in the milk is given, when the whole-milk has the fat content stated in the first column on the left.

As regards cheese with 10 % fat in dry matter, data are given on the right, relative to the addition of whole-milk, as difficulty has been found at the dairies in estimating the fat content by the GERBER method.

II. When the Government control of cheese production was started in 1921, the samples of cheese taken for examination and the chemical analyses were referred to the chemical department of the Laboratory, which had in consequence to undertake the determination on a large scale of the fat and dry matter in cheese.

It was recognised that the method usually employed in all laboratories for the estimation of dry matter must be adopted, viz., drying on pumice of the weighed, broken curd, at a constant temperature of 98-100°C. In the case of fat determinations, however, the ordinary method of SCHMID-BRODZYNSKI-RADZLAFF (called S.B.R. method) is too slow and expensive for large scale examinations.

It was seen that use would have to be made of one of the so-called practical methods which allow of numerous determinations being made in more reasonable time and with far less expense, although the result is less exact. The choice had to be made between the method of VAN GULIK and that of COOPER, exact fat determinations by the S.B.R method being made at the same time.

The following conclusions were drawn :

(1) As a result of careful estimations of the fat content of hard cheeses it was found that duplicate determinations, only in one case out of three on an average, deviate more than about 0.07 and in one case out of twenty, more than 0.15.

The same will be found to be the case as regards moisture determinations, except with Rochefort cheeses where deviations of about double the above may be found, while the determinations of moisture do not deviate much more than those of hard cheeses.

(2) On the determination of fat in dry matter this variation as regards hard cheeses involves uncertainty to such a degree that, if from the average results of two fat and two moisture determinations is calculated,

the fat content in dry matter, F., a repetition of the determination under the same conditions and on the same sample of cheese will with:

a probability of 2/3 lie between F + 0 1 and F − 0.1
» » » 19/20 » » F + 0.2 aud F − 0 2
» » » 997/1000 » » F + 0.3 and F − 0 3

As regards Rochefort cheese the limits must be calculated at 0.2, 0.4 and 0.7 instead of 0.1, 0.2 and 0.3.

(3) Each individual cheese proved to be so non-homogeneous that considerable differences in the results of testing are inevitable. If the fat content of the dry matter in a hard cheese is estimated from two fat and two water determinations and the value F is thus found, by repeating the determination under the same conditions, but on another sample of the same cheese, a result will be obtained the value of which will with

a probability of 2/3 lie between F + 0 2 and F − 0 2
» » » 19/20 » » F + 0 4 » F − 0 4
» » » 997/1000 » » » + 0.6 » F − 0.6

Rochefort cheeses must be calculated with a variation three times as large, consequently with the limits 0.6, 1.2 and 1 8 instead of 0.2, 0.4 and 0.6.

(4) As a quick method van GULIK's modification of the GERBER method is to be preferred to that of COOPER, especially if it is not a case of large scale examinations.

(5) The results of van GULIK's method compare very well with the results of the S B.R method for cheese with 30-40 % of fat in dry matter. With a very high fat content van GULIK's method on an average shows more, in skimmed cheeses, however, less that the S.B.R. method.

(6) Simultaneously executed analyses made by the GERBER-van GULIK method on the same grated cheese sample, will only on an average in one case out of 20 deviate more than 0.2. Nevertheless, the GERBER-van GULIK's method must be reckoned to be subject to experimental errors four times as great as the S.B.R. method.

Provided the "fat content in dry matter" in a cheese is found partly from the mean of the two fat determinations by the S.B.R. method and the mean of two moisture determinations, and partly from the mean of two fat determinations of GERBER-van GULIK's method and the mean of two moisture determinations, together with the application of the above-mentioned corrections, the difference between the two values of fat in dry matter will on an average in

2 cases out of 3 be less than 0 4
16 » » 20 » » 0.8
997 » » 1000 » » 1.2

These limits only apply to hard cheeses. The figures for Rochefort cheeses must be multiplied by about 1.5.

The working method of the Government Cheese Control is as follows: the taste-sample taken out by the Controlling Authority with a cheese-scoop is examined by means of the GERBER-van GULIK method, while the more accurate but more elaborate method, will only be employed for the cheese-sector cut out in larger pieces, which perhaps may be sent in for after-control. Deviations as mentioned above between the stated fat content in dry matter, in respectively the taste-sample and the sector, will prove unavoidable, but the experimental error having a double sign, there is just as much probability that the examination of the sector-sample will give a larger fat content in the dry matter, as there is that it will lead to a smaller content of fat in the dry matter, or that it will show a smaller content of fat in the dry matter than that proved by the taste-sample.

In the case of examination of especially non-homogeneous cheeses, wider limits for errors than those stated must be reckoned with.

(Denmark Corr.)

364. On the Flora and Preparation Processes of Kephir.

SANCHEZ, G. (Laboratoire et Biothérapie lactique. Carrion et Laguel). *Le Lait*, Year 4, Vol. IV, No. 38, pp. 621-626, Lyons 1924.

The author considers that the combination of chemical, physical, biological and dietetic qualities which characterise the best kephir, enable three categories of species to be distinguished:

A. *Lactic ferments:* 2 diplococci and a chain generally formed of 6-8 rather large cocci. The organisms are Gram positive; coagulate milk; the acidity produced is not above 1 % of lactic acid. The curd given is of the comparative inconsistency and slight tendancy to crumble indicative of good kephir. The diplococci develop a delicate aroma and the chain-form dissolves the casein to a certain extent.

B. *A yeast* producing carbonic acid and traces of alcohol; it alone ferments milk and does not cause the slightest flavour of beer.

C. A special bacillus, similar in properties to *Bacillus caucasicus*. It coagulates casein, which is dissolved and peptonised to a rather marked degree. It is mobile and acidifies the surrounding medium. An in-curved slightly mobile bacterium, found by the author in kephir grains, seems to be related to the *Bacillus cacasicus* species.

According to the author, many species found at the surface, or at a depth in the kephir grain, must be regarded as taking no part in the real kephir fermentation, such for instance as the glairy, lactic streptococcus, a pink torula, yellow sarcinae, various species of oidium, *Mycoderma aceti*, fungi such as *Aspergillus*, *Penicillium*, and sporulating organisms such as *Bacillus butyricus*.

After isolating some grains and keeping them is strictly pure cultures, the author succeeded in obtaining the ferments, which, after mixing in suitable proportions were inoculated into milk which had been sterilised by heating to about 100°C., the milk being then poured into flasks which had been sterilised in the autoclave.

These flasks were closed and placed in an automatically regulated oven, when a remarkably constant kephir was produced of the the most desirable quality. Neither during fermentation nor afterwards were any parasitic ferments found, capable of injuring kephir produced direct from the grains. P. D.

365. The Citric Acid Content of Milk Powder.

STEUART, D W. *The Analyst*, Vol. XLIX, No. 583, pp. 465-467. Cambridge, 1924.

In his researches, the author has used STAHRE's pentabromaceton method and BEAU's mercury sulphate method. He observed that the citric acid content of milk powders is very high, and equal to about $^1/_5$ of the ash. A sample of fresh milk gives 0.158 % of anhydrous citric acid. Whole milk powders give an average of 1.16 % and skimmed milk powders 1.56 %, or together 0.144 % in the milk which has served for making the powder. P. D.

366. General Review of Milk Butter and Cheese in Egypt.

AZADIAN, A (Chemist, Public Health Department of Cairo) *Annales des falsifications et des fraudes*, Year 17, No 192, pp 528-538 Paris, 1924

In Egypt, cow's milk, buffalo's milk, and to a less extent, goat's milk are utilised In the towns the milk is supplied to the inhabitants by three classes of vendors :

(1) The dairies, belonging to Europeans.

(2) The native vendors, who go round on foot or riding on an ass with 2 wooden vessels containing about 25 litres of milk.

(3) The cowherds who go round with a cow accompanied by its calf, selling the milk from the udder.

There are also herds of goats, the milk of which is also sold from the udder.

A milk control was instituted by the Public Health Department about 10 years ago , the Inspector's Office of the City of Cairo carries out this work. The samples of milk are taken by the sanitary inspector or by the sanitary officers of the various districts.

In 1923 the total number of samples inspected was 1135, of which 800 (77 %) were normal, 95 diluted (9 %), 124 skimmed (12 %), and 26 diluted and skimmed (2 %) ; a total of 242 adulterated samples, or about 23 %. There were also 15 abnormal samples and 75 doubtful.

The following figures are the results of an analysis of 61 samples of buffalo's milk ; each sample is a mixture of the complete milking of 6 animals :

	Minimum	Maximum	Average
Specific weight	1.0294	1.0343	1.0323
Total Solids	15.81	19.75	17.91
Fat	6.05	9.75	7.96
Solids less fat	9.42	10.40	9.95
Lactose	4.65	5.19	4.86
Albuminoids	3.57	4.80	4.16
Ash	0.70	0.84	0.78
Alkalinity of Ash	7.2	9.2	8.2
Chlorides	0.04	0.10	0.08

The minimum requirement for a normal buffalo's milk is fat 5 %; solids less fat 8.5 %.

149 individual samples of cow's milk gave:

	Minimum	Maximum	Average
Total solids	9.25	20.55	14.63
Fat	0.60	11.00	5.44
Solids less fat	7.55	10.95	9.19
Refraction of serum at 30° C	30.7	39.8	36.94

It should be observed that these were individual samples and that therefore many factors were influential, such as: temperature, age, feed, time of milking and especially of feeding. The dairy farmer often gives the cheapest possible feed, *i. e.* " bouza " waste (" bouza " is an alcoholic drink prepared from fermented bread); in good cowhouses, on the contrary sesame cake and good hay are fed.

The minimum requirement for normal cow's milk is: fat, 3 %; total solids less fat, 8.5 %.

The milk of goats which are led through the streets is always very poor and the variation in composition is great, for the feed leaves much to be desired. The minimum requirement for goats' milk is: fat 2.50 %, total solids, 7.50 %.

The analysis in general use includes the following determinations: total solids estimation of fat content by the GERBER method and refraction of serum by the ACKERMANN method; if a contra-analysis is made, GOTTLIEB's method is used for fat estimations.

Butter: There are two kinds of butter on the market: full cream butter and " brêche " butter, which has not such a good flavour and turns rancid more easily. The natives use melted butter, " Samna " or " Samn " for the kitchen, taking in a stock from February to March for the whole year.

The butter is prepared by the peasants or fellaheen in a primitive way. On being sent to town, it is mixed, melted and the contained water evaporated; it is then salted and poured into pots and hermetically sealed. At the bottom of the cauldron in which the melting takes place, a casein product called " morta " remains.

The butter is mostly made from buffalo's milk and is white, unless it has been coloured with curcuma. When well made it is firm and granular and has a pleasant flavour and smell.

There are no laws in Egypt regulating the sale of butter, and that sold on the market contains a large percentage of water.

Analysis of buffalo's and cow's milk in Egypt.

	Buffalo's milk			Cow's milk		
	Minimum	Maximum	Average	Minimum	Maximum	Average
Zeiss at 40° C. . . .	40.4	44.0	42.5	40.6	45.3	42.9
Reichert.	24.5	37.5	31.2	21.3	31.6	26.1
Polenske	1.0	2.8	1.5	1.0	2.8	2.1
Saponification	218	235	229	213	237	227
Hubl.	23.0	39.7	31.4	24.1	44.5	34.4

Cheese. All kinds of cheese are found on the Cairo market, especially the Balkan or Greek cheese

The cheese mostly made in the Country is the soft white variety. Either whole milk, or milk partially or completely skimmed are used. There are several varieties of white cheese, all being preserved in salt water:

(*a*) the " stambolli ": in square blocks of 250-300 gms., or round cheeses of 150-200 gms.

(*b*) the " halum ": prepared by the fellaheen and containing a high percentage of water;

(*c*) the " Damietta ": in small balls of 30-40 gms.

The *seret*, fairly well made, is also sold nearly everywhere.

There is also a preserved cheese, or "guibnetmesh" the white cheese is put into earthenware receptacles, milk, salt and Cayenne pepper are added, and the receptacles are then closed hermetically.

Instead of milk, water and a little " morta " may be added.

The hermetically sealed pots are kept at least 6 months; at the end of this period they are opened, the quantity for the day's consumption is taken out and a little sauce or " mesh " is added. P. D.

367. The Preservation of Shelled Eggs.

COUDIS, C. H *La Hacienda*, Vol. XIX, No. 11, pp 234-327, figs. 4. Buffalo, N. Y., U S. A, 1924.

The author considers that about 20 000 million eggs are produced annually in North America, of which many are spoilt in transport, through exposure to the weather and the treatment they undergo before consumption. The author then mentions the great value of this "complete food" owing to its content in protein, vitamines, fats and mineral salts.

Dr. M. E. PENNINGTON (of the Food Research Laboratory) was appointed by the United States Government to carry out investigations for the purpose of avoiding this loss, and concluded from experiments made by TITMAN that the best means of preserving eggs was to shell them while fresh and keep them in cold storage.

This process is being developed on a large scale by TITMAN at Boston. Large quantities of fresh eggs are received daily, especially in spring and summer. They are all examined with special ovoscopes by means of which it can be ascertained whether they are good or not. Those rejected are sent through tubes to the lower floor of the building. The good eggs are sent to the shelling room, which is kept at a temperature of 19°C Each operator shells 6,000 eggs daily; the factory can prepare and pack 500 000 daily As soon as the shell is broken the contents are poured into antiseptic basins, again examined and all those which are unsound are rejected, and the remainder are poured together into receptacles which, as they are filled, are sent to an electric mixer. A uniform and homogenous liquid is formed and poured into 30-lb. tins, which are immediately sent to the refrigerating rooms where they are kept at a temperature of — 22°C The installation of the establishment is supplied with all kinds of disinfectant material, refrigerator wagons, elevators, etc E M. F.

PLANT DISEASES.

Plant Parasites.

368. Field and Forest Plant Diseases, especially those of Plants Cultivated in Belgium and the Belgian Congo.

MARCHAL E Éléments de Pathologie végétale appliquée à l'Agronomie et à la Sylviculture (Bibliothèque agronomique belge, No 2) One Vol, octavo, of XVI + 312 pp., with 148 figs in the text J Duculot, Gembloux, 1925

In this book, intended for general use but written on a scientific basis, the author, who is a Professor at the Agricultural Institute at Gembloux and also Director of the Government Station of Phytopathology situated in the same town, proposed not only to summarise the progress made up to recent years in Plant Pathology in Europe and still more in the United States of America, but also to bring together for the first time in a hand-book descriptions of parasitic plant diseases and the non-parasitic or physiological diseases which more especially attack field, garden, fruit and forest plants cultivated in Belgium and Belgian Congo, without however omitting matters of interest from a phytopathological point of view in other countries.

The book is divided into three parts: In the first part, after having treated of parasitism and parasites in general, as well as of various preventive means adopted against the latter, the author passes in review successively the principal species of Bacteria, Mixomycetes, Fungi, Algae, Lichens and Phanerogams living as parasites on cultivated plants, including the following: cotton, cocoa, *hevea*, palms (coconut, *elaeis*, *phoenix chamaerops*), coffee, tea, sugarcane, etc. In the appendix to the study of the parasitic diseases of plant origin, the more important virus diseases to which tobacco, tomatoes, sugar-cane, etc., as well as the potatoes are subject, are examined.

The second part deals with the more important non-parasitic and physiological diseases attributed to environmental factors, such as soil, light, heat, atmosphere (and in particular, owing to the presence of sulphurous anhydride, in addition to acids and various matters, dusts, generally of industrial origin), meteorological factors, and lesions from various causes determining the total or partial loss of some tissues or organs of the plant.

The last part consists of a series of tables based on external characters, which enable one to determine the parasitic diseases of plant origin which are mostly found on plants cultivated in Belgium and the more important plants, from an economic point of view, of the Belgian Congo.

A detailed index of the contents of the volume is given G T.

369 *Sclerotium monohistum* n. sp., a Maize Parasite, in Morocco.

MARESQUELLE Sur un *Sclerotium* parasite du maïs *Revue de Pathologie végétale et d'Entomologie agricole*, Vol XI, Part 2, pp. 156-159, Fig 1 Paris, 1924.

During the latter part of the summer of 1923, the Institute of Plant Pathology at Paris received from Rabat (Morocco) a fragment of corncob attacked by an unknown disease the centre of the cob was full of black granules, which had spread along the vascular bundles and the disease was recognised by the author as sclerotium. From a culture of these were quickly and repeatedly obtained a delicate mycelium and numerous sclerotia, in appearance identical with those found in the cob. The attempts to inoculate maize and other cereals gave negative results.

The author considers the cause of the disease to be a new species of *Sclerotium*, to which he gives the name of *Scl. monohistum* from the fact that it differs from other species of *Sclerotium* in having a distinctly homogeneous structure, that is, without any separation into an external cortical stratum and an inner medullary mass. G. T.

370. Bacterium sp. and *Coccus* sp. injurious to Beans in Costa Rica.

PICADO, C. Une maladie des haricots (Association bactérienne parasitaire d'espèces antagonistes en vie libre) *Revue de Pathologie végétale et d'Entomologie agricole*, Vol XI, Part 2, pp 150-155, Tables 2 Paris, 1924.

Bean crops are often severely damaged in Costa Rica by a disease known locally as "hielo" (ice), because it is popularly supposed to be due to a sudden fall in temperature. When the disease is of an acute character, the plants wither and die from day to day; at other times the plant survives, but has a poor appearance and yields little or no fruit. The disease is characterised by dry scars resembling burns, situated in those parts of the stems which are underground; sometimes there is a single scar equal in width to the stem; in other cases there is a large number of small brown spots. The disease may be examined when the crops are gathered. The plant, on being pulled up from the ground, breaks off at the level of the scar, where the whole parenchyma is disorganised. In longitudinal sections of the stem the vessels are brown in colour for a length of some centimetres.

An examination of the sap of the diseased tissues reveals the presence of two distinct bacterial forms (*Bacterium* sp. and *Coccus* sp.), of which cultures have been made and isolated.

Tests clearly proved that *Coccus* sp. may be associated with *Bacterium* sp. in the spontaneous or experimental disease (direct inoculation), but that only *Bacterium* sp. can cause the disease, which should therefore be considered as the pathogenical agent of the disease. Further tests showed that *Bacterium* sp. and *Coccus* sp., associated as parasites, become antagonistic in their independent existence in the soil, and that the *Coccus* sp. destroy the *Bacterium* sp.

It is sufficient to contaminate the bean seeds before sowing with *Coccus* sp. in order to destroy the pathogenical agent (*Bacterium* sp.) and prevent the disease from breaking out. G. T.

371. *Sclerotium* sp. injurious to the Sugar Beet, in Morocco.

BARBIER A. M. Sur une altération de la betterave causée par un *Sclerotium*. *Revue de Pathologie végétale et d'Entomologie agricole*, Vol. XI, Part 2, pp. 160-163, Table 1. Paris, 1924

Sugar-beet roots, sent in June, 1923, from Rabat (Morocco), to the Station of Plant Pathology at Paris, showed small black excrescences, mostly situated on the line of insertion of the roots.

Section of the diseased parts reveal small groups of sclerotia in the upper tissues of the parasite.

In culture, these sclerotia develop a mycelium, from which new sclerotia soon form.

From the form of the sclerotia, the fungus which appeared on the sugar-beet in Morocco resembles *Sclerotium Oryzae* Catt. and differs, on the other hand, from *Scl. Rolfsii* Sacc. and *Scl. cepivorum* Berk. G. T.

372. *Mauginiella Scaettae* n. gen. and n. sp., a Hyphomycete injurious to the Date Palm, in Cyrenaica.

CAVARA, F. Floral atrophy in the Cyrenaican " Phoenix dactylifera ". *Rendiconti delle sedute della Reale Accademia Nazionale dei Lincei*, Vol. 1, 1st session, Part 2, pp 65-67 Rome, 1925.

During the spring of 1924, in some palm groves in the neighbourhood of Bengasi (Cyrenaica) arrested growth was noticed in the male inflorescences of *Phoenix dactylifera*, the spathe failing to open, or the flowers being completely atrophied, whence it was impossible to utilise the inflorescences themselves for the practice of artificial pollination.

Under a microscopical examination the secondary axes of these inflorescences appeared cloudy white in colour over the whole of the upper portion, with blackish spots disseminated with white tufts in the lower portion. Large blackish spots were also observed on the principal axis.

The white down which mostly covered the extremity of the secondary floral axes, showed under the microscope the presence of conidia belonging to a hyphomycete, considered by the author to be the cause of the floral atrophy of the date palm. The parasite has an endogenous mycelium, and though cultivated in various media, produced no other form of reproductive organs than the conidia directly inserted in the mycelium, which, on maturity are set free in the usual manner. This parasite, according to the author, belongs undoubtedly to the Mucedineae and includes a genus (*Mauginiella*) and a species (*M. Scaettae*) new to science, described in this preliminary note and of which the respective Latin diagnoses are given. G. T.

373 ***Coryneum*** **sp., a Melanconiacea injurious to the Japanese Chestnut.**

DUFRENOY J. and GAUDINEAU M. Sur une maladie causée par un *Coryneum* nouveau. *Revue de Pathologie végétale et d'Entomologie agricole*, Vol. XI, Part 2^a, pp 164-167, Tables 2. Paris, 1924.

In the Department of Ardèche, at Levada, some trees remaining over from a large nursery of Japanese chestnuts, transplanted in their seventh year and now about 25 years old, show longitudinal streaks on the trunk, of a somewhat different colour from that of the rest of the bark, and bearing pustules. These streaks continue above the bifurcations of the larger branches. The smaller branches of these trees are almost all stripped of their leaves, and show here and there clusters of black pustules, almost circular at first, afterwards ellipsoidal, also, there is a swelling of the outside bark

Sections made in the bark on a level with the pustules reveal the existence of a stroma bearing conidia of a Melanconiacea (*Coryneum*) not specifically determined by the authors, but considered by the them to be new. It is different from the various species of *Coryneum* hirtherto described as parasites of the chestnut,. both in Europe and America. G. T

Animal Enemies.

374. ***Isobremia kiefferi*** **n. sp., a Dipteron parasitic on Aphides in Jugoslavia.**

VOUKASSOVITC, P. Observations biblogiques sur un Diptère, *Isobremia kiefferi* n sp., parasite des Pucerons. *Comptes rendus des séances de la Société de Biologie et de ses filiales*, Vol. XCII, No. 5, pp. 357-359. Paris, 1925.

The author, who has carried on research work in the laboratory of the Entomological Institute of the University of Belgrade, reports having observed the Dipteron *Isobremia kiefferi* n. sp. as a parasite on the rose aphides (*Macrosiphum* [*Aphis*] *rosae* and *Myzus* [*Aphis*] *rosarum*), of the aphis of *Sonchus* (*Aphis* [*Macrosiphum*] *sonchi*) and of certain other unspecified aphides.

The genus *Isobremia* Kieff previously contained only one European species, *I. sonchi* Kieff., the larvae of which are external parasites of *Aphis sonchi*.

The female of the new Dipteron lays her eggs on the parts of the plant which have been attacked by the aphides, either close to or actually among them, or even on their bodies The larvae at once find an aphis and fix upon it, preferably on the ventral side of the thorax but also frequently on the abdomen and in that case also always on the ventral side. The aphis attacked by a larva makes no reaction; it is paralysed or destroyed by the poisons passed into the system by the larva after fixation. The author has frequently been able to observe in nature three or four very small larvae of the Dipteron attached to the same aphis. The dead aphides do not differ as a rule from the healthy, except that the skin appears to be slightly wrinkled.

An account is given of the biological observations made of the later stages of the development of the Dipteron, and the author further states that a certain number of larvae of *I. Kiefferi* were infested by the Hymenopteron *Proctotrupis Synopeas rannis* Walk. the larvae of which are internal parasites. G. T.

375. *Protapanteles marquesi* n. sp., a parasitic Hymenopteron of *Papilio anchisiades capys*, a Lepidopteron injurious to the Orange in Brazil.

DE AZEVEDO Marques LUIZ, A Vespa versus lagarta. *Chacaras e Quintaes*, Vol. XXIX, No. 2, pp 109-110, Table 1 S Paolo, 1924

In May, 1923, at Rio de Janeiro, the author found a small hymenopteron which Dr J BRÉTHES, to whom he had submitted it for classification recognised and described as a new species under the name of *Protapanteles marquesi*. This, according to the author's observations, is an effective endophagous parasite of the caterpillar of the Lepidopteron *Papilio anchisiades capys* Hubner, which is very injurious to the orange, and attacks the leaves at various seasons of the year

The discussion on the new hymenopteron by Dr. BRÉTHES is given.
G. T.

376 *Metadrepana andersoni* n. sp., a Microlepidopteron injurious to Coffee in Kenya.

TAMS, W H T. Description of two new species of the genus Metadrepana (*Drepanidae, Lep*) *Bulletin of Entomological Research*, Vol. XV, Part 3, pp. 289-291, figs 4. London, 1925.

A description of *Metadrepana andersoni* n. sp., the caterpillars of which, in 1922, in the Colony of Kenya, injured the coffee-plant by stripping it of its leaves.

M. pallida, collected in Northern Nigeria, is also described as a species new to science, but without any indication as to its economic importance. G. T.

377. The "Potato Moth" (*Phthorimaea operculella*) found on Tobacco, in Brazil (1).

BURGESS, P. S. (Rhode Island Agricultural Experiment Station). *Soil Science*, Vol. XVIII, No. 3, pp. 169-172. Baltimore, Md., 1924.

During the month of May 1924, the tobacco plantations of the Jaguarayara district were attacked by the "potato moth" (*Phthorimaea operculella* Zell.).

This Microlepidopteron was also observed on tobacco in Bahia and the surrounding district. The author thinks that it may exist throughout the State of Bahia.

In addition to tobacco, *Phth. operculella* has been found on other Solanaceous plants, for instance, the "Jurubeba" (*Solanum paniculatum* L.).

On tobacco the damage caused by the "'Moth" is of relatively small importance, as the larva mostly attacks the lower leaves, which have no economic value, while it is rarely found on leaves 30 centimetres above the soil. In "nurseries" and on newly transplanted seedlings, however, these insects can cause considerable damage.

Investigations carried out in all the Brazilian States, more especially as regards the cultivation of tobacco (potato planting is very limited), will decide whether *Phth. operculella* is an indigenous or an imported species; the results of these studies will indicate the best means of controlling the parasite G. T.

378. *Lophyrus similis*, a Hymenopteron reported as Injurious to *Pinus Cembra* in Switzerland.

BARTHEL C. Un lophyre ravageur du pin cembro (Arolla) *Journal forestier suisse*, Year 75, No. 10, pp. 189-191, table 1. Bern, 1924.

At Pont de Nant-sur-Bex (Canton of Vaud) at a height of 1253 m., well-developed pines, 20 years old and 3-5 metres high, were found on 26 July, 1924, to be partially stripped of their leaves, both the new leaves and those of the previous year, by the *Lophyrus similis* Htg. larvae. This hymenopteron had not previously been observed as a parasite of *Pinus Cembra.*

Other conifers of the *Pinus* and *Piceae Abies* genera, grown in the same locality, remained immune from all attack.

This hymenopteron has not been noticed in other plantations of cembrus in the same valley.

Measures have been taken for the immediate destruction of the insect in the zone invaded. G. T.

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(1) See also *R.* Oct.-Dec., 1923, No. 811. (*Ed.*)

379. *Thaumetopoea wilkinsoni* n. sp., a Macrolepidopteron injurious to Pine Trees in Cyprus.

TAMS, W. H. T. A new processionary moth (Notodontidae) injurious to pine trees in Cyprus. *Bulletin of Entomological Resarch*, Vol. XV, Part 3, pp. 293-294, 3 figs. London, 1925.

The Macrolepidopteron *Thaumetopoea wilkinsoni* which, in its larval state, has caused serious injury to pine trees in Cyprus, is described as a species new to science.

G. T.

CURRENT NOTICES

Legislative and Administrative Measures

380. **Austria : Legislative measures relating to the trade in clover seeds, seeds of timothy grass and flaxseed.** – In certain districts of the Austrian Federation there are laws compelling agriculturists to destroy dodder in the fields (e. g. Law of 2 January 1883 in Lower Austria, *Landesgesetzblatt* N. 3, 1885). These however refer only to the dodder actually observed on the fields, but not to the clover seeds which, as is well known, are often put on the market with an intermixture of the seed of this parasite The publication of a law against trade frauds (Federal Law of 26 September 1925, *Bundesgesetzblatt für die Republik Oesterreich*, No. 531, 1925) gave the Federal Government the opportunity of regulating by a decree the trade in seeds which were often impure owing to the presence of dodder. The decree came into force on 1 December 1924 and in accordance with its provisions seeds may be put on the market, in quantities larger than half a quintal, only in bags sealed with the seal of the Federal Inspection Bureau, and only bags containing seeds found to be wholly free from dodder may be so sealed. In addition to the seal and the words « Free from Dodder » the place of origin must be plainly marked on the bags with the name of the State belonging to the Federation, together with the words ' Austrian goods '. Seeds for sale in quantities of less than 5 kilogrammes do not come under the regulations as to bagging or as to declaration of place of origin and quality, and thus home grown seeds when not for sale are not bagged or sealed for this purpose.

As regards the quality, seeds are distinguished as follows : (*a*) in the natural state ; (*b*) sifted seed ; (*c*) screenings or siftings : seeds fit for use.

The country of origin must be indicated in the case of seeds from foreign countries. From time to time the bodies empowered to inspect and seal the sacks will be designated, and they are empowered to employ persons sworn for the purpose of taking samples. A tax is payable on the affixing of the seals. The responsibility for the proper execution of the provisions of the decree rests with the district administrative authority and with the Federal Institutions responsible for the sealing of the sacks. (*Bundesgesetzblatt für die Republik Oesterreich* ; No. 64, 13 August 1924).

381. **Legislative measures against diseases and pests of plants grown in Austria.** – The ' Landtag ' of Carinthia has passed a law which

is the first comprehensive enactment of the kind in Austria. In paragraph 1 the law regulates the measures for the control of all plant pests, including weeds, but excluding birds and mammals which come under the game law. The law compels landowners, tenants, holders in usufruct, managers of farms, etc.: (*a*) to use the utmost care to keep their holdings free from noxious insects and disease, using the proper control measures and at the appropriate season whenever possible, (*b*) individually to comply with the regulations laid down by the authorities either for prevention or control, or to take part in collective action for the purpose; (*c*) to assist, by assigning the necessary labour and paying all costs thereof, in the carrying out of a joint scheme of control; (*d*) to notify to the communal authority the appearance of noxious insects, diseases or any suspicious signs of a probable visitation; (*e*) to contribute information to the official enquiries to be made in this connection.

Access must moreover be allowed to the farm, the storehouses, farm buildings, etc., for the necessary official reports and for carrying out the control measures The communal authorities are responsible for seeing that the farmer complies with the provisions of the law, and in cases of urgency may enforce the application of the proper measures and the assistance of every person in the neighbourhood who is conversant with them.

In case of neglect on the part of the landowner. the Mayor may order the official execution of the necessary operations and at the owner's expense. The communal authority passes on the notices of the appearance of noxious insects or of diseases to the State authority when the commune itself has not the necessary resources for instituting control measures Joint premiums may be assigned for such measures at the communal expense The political authority may, in its turn, arrange for the execution of what work is necessary, charging the cost to the commune, in case of non-compliance with the provisions of the law

The government of Carinthia has the power (*a*) to prescribe in general fixed methods or means of control of noxious insects and plant diseases; (*b*) to order the carrying out of preventive measures; (*c*) to issue special instructions in certain cases, (*d*) to exercize a regular supervision of fish-ponds, nursery gardens, florists' depots, etc , (*e*) to prohibit the sale of plants and trees on the market or by travelling vendors; (*f*) where necessary to declare places referred to under (*d*) as infected, or, as a preventive measure, prohibited.

When joint action is taken for controlling noxious insects and plant diseases, the Government is empowered to supply, the parties concerned with the apparatus necessary for the work on suitable terms, or to meet the consequential expenses by means of a loan In given cases the Government may grant subsidies, to the extent of available resources, (*a*) for the purchase and distribution on special terms of the apparatus required for control; (*b*) for the purchase of seeds, cuttings or suckers; (*c*) for the payment of premiums; (*d*) for the cost of securing the proper observance of the legislative provision; (*e*) for compensation to persons who have incurred losses through the carrying out of the control measures

In accordance with the general provisions made by the authority the measures must be carried out simultaneously and with the utmost care on the roads, in cemeteries, along dykes, in quarries and factories as on other communal areas, at the expense of the commune and by means of labour provided by it.

The State authorities are also required to work in conjunction with the Agricultural Experiment Stations and with other competent bodies. The president (*Landeshauptmann* of Carinthia) is authorized to issue special instructions for the prophylaxis and control of different diseases. In this connection a series of measures are contained in the order accompanying the law for the extirpation of barberry (*Berberis vulgaris*); for destroying cockchafers so as to check so far as possible the socalled cockchafer season: for the destruction of *cuscuta trifolii*; for reporting the appearance of the apple weevil, clover dodder, black potato scab; for removing caterpillars from fruit-trees, and burning them; for thinning out fruit-trees, scraping the bark, painting with lime, etc. (Law of 25 September 1923 on the control of against plant diseases and pests *Landesgesetzblatt für Kärnten*, No. 6, 11 April 1924; Ordinance 11 April 1924, of the President of Carinthia for giving effect to the preceding law. H.).

382. **Control of Cockchafers (*Melolontha vulgaris*) in the country districts of Lower Austria.** — The appearance of swarms of cockchafers on an alarming scale caused the Government of the province, on the request of the Chamber of Agriculture, to compel the owners of farms, tenants and holders in usufruct to exterminate the beetles and their larvae and to take part in common action for the purpose under the supervision of the Mayor of the place. With a view to making the measures still more effective school-children can be called in to help, working in groups under suitable leadership.

By way of encouraging the children to do their utmost, the Chamber of Agriculture instituted for 1924 a general prize of 200 crowns. (Verordnung des Landeshauptmannes für Niederoesterreich vom 30 April 1924 womit auf Grund des Gesetzes vom 17 mai 1912, *Landesgesetzblatt*, No. 81, betreffend den Schutz des Bodenkultur gegen schädliche Insekten, Durchführungsbestimmungen bezüglich der Maikaferbekampfung erlassen werden. *Landesgezetzblatt* 64, 30 April 1924, Vienna)

383. **Encouragement of Horse Breeding in Lower Austria.** — The Lower Austrian Chamber of Agriculture (*Landeslandwirtschaftkammer*) has undertaken the work of encouraging horse breeding in the province. The Regional Horse Breeding Commission (*Landespferdezuchtkommission*) represents the central body and consists of: (1) two expert representatives of the Chamber of Agriculture; (2) a representative of the Federation of the Lower Austrian Consortia for Horse Breeding; (3) a representative of the Lower Austrian Government; (4) the stud officer of Lower Austria in charge of the government stallions: (5) the Director of the Section of Zootechnics of the Chamber of Agriculture already metioned. A delegate of the Federal Ministry for Agriculture and Forestry is invited to attend every meeting.

The work of the Commission includes: (1) official approval of the stallions; (2) to establish and approve the fixing of districts for breeding each sub race, thus obviating the possibility of the influence of more than one sub race in any one district; (3) to take part in the official approval of stallions at shows, and to supervise the action of District Commissions and Horse-

Breeders' Consortia; (4) to propose the purchase of stallions for service stations offered for the purpose, to fix rates for stallions, etc, and to advise the Chamber of Agriculture (of Lower Austria) in any question relating to horse breeding.

In every district in which it is considered necessary a District Commission for Horse Breeding is appointed, usually at the headquarters of the District Agricultural Chamber, constituted as follows: (1) a chairman; (2) a breeder of high scientific reputation; (3) a veterinary officer who will keep the registers of the Commission.

The duties of the District Commission are: (1) to approve the mares and keep the registers of the approved animals; (2) to refer to the Lower Austrian Chamber of Agriculture all proposals, reports and offers from third parties in respect of any question of horse breeding, more especially in the district and to advise the District Chamber of Agriculture; (3) to organize horse shows and offer prizes: (4) to safeguard the interests of horse breeders; (5) to set up and maintain, with the consent of the Lower Austrian Chamber of Agriculture, institutions and organizations for the encouragement of horse breeding; (6) to give technical advice to horse breeders and to the respective horse breeding organizations and generally to exercise a beneficial control.

For the current year already approved stallions only are admitted to the mounting stations together with the government stallions of the Confederation.

The precise instructions in regard to the approval of stallions are contained in paragraph 14 of the law on horse breeding Special instructions for methods of judging and for the management of mounting stations are contained in a regulating order tor Lower Austria, contained in the *Landesgesetzblatt*, No. 34, of 5 February 1924.

Paragraphs 22-26 contain instructions for the management of a mounting station, including the compilation of the registers, the supply of mounting certificates to the owners of mares, diseases to which stallions are liable, etc. An important provision is that every registered stallion must be inspected once a month by the veterinary officer.

By the terms of paragraph 27 mayors are required to make statistical returns every year on 1 January of all horses in the commune that are suitable for breeding purposes, and to forward the information so obtained to the District Chamber of Agriculture, If it appears that there are in the district at least 25 owners of mares fit to be served a ' Horse Breeding Consortium ' may be proposed by the Chamber. Such a Consortium may also be established if required by at least 25 owners of mares In districts where such a Consortium is already in existence, the District Chamber of Agriculture must summon every year a district meeting to decide on all questions relating to the horse breeding of the district.

Paragraph 28 lays down rules for the annual approval of mares, and it is an important feature that only members of the Consortium or applicants for membership may present their mares for the official approval. The approved mares are noted in the appropriate register, and a certificate is handed to the owner of the animal.

All the Consortia are combined in a Federation. The federated State is responsible for all expenses connected with the official approval of stallions and mares, except when an owner himself requires that animals newly purchased be approved, in which case he is responsible for the costs.

Fines up to a million crowns are imposed by the district authorities on persons who (1) employ for mounting purposes stallions not approved, (2) have their own mares served by stallions not approved, (3) employ for mounting purposes a stallion of their own belonging to a sub race not authorized by the Lower Austrian Commission for breeding purposes in a given zone, (4) allow stallions of two or more years old to pasture with mares promiscuously.

The following provisions are important: official approval may only be given in the case of stallions which belong to a well defined breed and are not the products of cross breeding. In the case of already approved stallions consideration is given to their capacity for the transmission of hereditary qualities and to the character of their offspring. Further provisions relate to the care, feeding and working of stallions intended for mounting, subsequent disinfection, prophylactic measures, registiation, fixing of mounting charges and arrangements for notification to the Lower Austrian Chamber of Agriculture (Law of 8 March 1923 relating to the promotion of horse-breeding in Lower Austria *Landesgesetzblatt*, No 87, 1923: order of 5 February 1924 of the Lower Austrian Government relating to the approval and maintenance of stallions on the basis of the law of 8 March 1923 (*Landesgesetzblatt* Nr. 34, 1924).

384. **Austria. Order in regard to diseases of bees.** — This order has reference to the Austrian Law of 6 August 1909 (*Reichsgesetzblatt* 177) on infectious diseases in animals, and in respect of bees makes compulsory the notification of brood diseases, of the appearance of *Nosema apia* in the epidemic form and of acaries. In any sporadic appearance of these diseases, the mayor must forbid any transport whatever of the hives affected, and must secure the destruction of diseased combs. Should there be a more general outbreak, the veterinary officers and a beekeeping expert must be called in, who if necessary will order the destruction of the bees attacked by the disease and the removal, with due precautions and in the evening, of the respective combs If the owner of the hive refuses to comply with these orders, he may be compelled to take measures to ensure that the bees do not leave the hive. The infected hives from which the bees have been removed must be burnt or at least cleansed and disinfected as far as possible

Swarms may not be taken from suspected apiaries, unless they have been asertained to be perfectly healthy. The epidemic is declared to be at an end, when after two months application of all the necessary prophylactic and disinfecting measures it is found that there are no further cases even of suspected disease.

The order concludes with a detailed account of the symptoms and nature of the diseases mentioned.

385. **Protection of the natural features of Lower Austria.** — By a law of 3 July 1924 the preservation of natural features, whether characteristic or unusual, is assured alike on economic, educational and, in respect of the landscape, aesthetic grounds. Since watercourses, lakes, nests of birds of prey, single trees or groups of trees may be declared to be natural features and in this way the right of the respective owners to dispose as they

please of their property is curtailed, the law affects agricultural interests very closely. Thus by paragraph 9 the State authority does not allow owners, tenants or holders in usufruct to modify or destroy the natural features, unless they are of a kind to endanger human life or there is reason to anticipate as the result of neglect or carelessness, any worse result. The owner, tenant or holder in usufruct have the right of appeal to the President of the State (" Landeshauptmann " of Lower Austria) against the refusal to authorize modifications of natural features, and such refusal may moreover only be pronounced after considering the report of the regional Chamber of Agriculture which is the representative of the agricultural interests. Article 10 pronounces it to be the duty of the authorities to take special care to preserve existing natural features, employing every kind of administrative procedure culminating in legislative measures relating to waters, forests, buildings, etc , and even setting aside funds for the purpose. If the demand for the work required does not issue from the owner, but from the special Office for the Preservation of Natural Features, this Office must be responsible for the expenditure

If the owner of any natural feature does anything to alter or destroy it, he may be compelled to restore it as far as possible to its original state With the object of preserving the landscape, the consent of the special National Office for the Preservation of Natural Features is required for the clearing of forest, as well as the consent of the competent forestry authority No rare trees or bushes may be cut down, nor may rare flowers or plants be gathered for commercial purposes, nor rare animals taken or killed The President of the State (province) may declare districts which are rich in natural features to be reserves, after however obtaining the consent of the respective owner. (*Die No 8 Landeskulturgesetze*, Vol. 1 Vienna, 1924. Publication of the Lower Austrian Chamber of Agriculture)

386. **Brazil: Permanent Production of Brazilian Coffee.** — By a presidential law of 19 December 1924, having force in the State of San Paolo, an *Istituto Paulista de Defeza permanente do Café* has been set up with the following functions. (1) the grant of loans to persons interested, on terms to be fixed by the Council of the Institute, and on pledge of the coffee stored in the State warehouses, (2) the purchase of coffee in the market of Santos and in any other home market with the object of temporary withdrawal from the markets, provided that the Council consider it necessary for the regulation of supplies; (3) the maintenance of a service of information, statistics and propaganda relating to coffee, for extending sales and checking adulteration (*Revista da Sociedade Rural Brasileira*, year VI, No. 55, 1924).

387. **Brazil: Protection of Sericulture in the State of S. Paulo.** — The Government of the province has enacted a law of the " Congresso Estadoal ", empowering the administrative authorities to agree to protection and propaganda for sericulture in the State of S Paulo through the agency of the National Silk Industry Limited Liability Company (*Sociedade Anonyma Industrias de Sede Nacional*). (*Brazil-Ferro-Carril*: Year XVI, vol. XXVIII, No. 382, 1924).

388. **Chile: Provisions regulating the Sale of Fertilizers.** — Sales must be made on the basis of a chemical analysis. For the purpose,

of the law the following are understood to be fertilising elements: phosphorus expressed as soluble anhydride ($O_2 P_5$), nitrogen, potash expressed as hydrate (KOH), calcium expressed as oxide (CaO) or sulphate ($CaSO_4$). For the time being the *Estación Agronómica* attached to the *Servicios agrícolas* carries out the analysis of the fertilisers, and regulations will be issued regarding the processes of analysis to be followed, and also specifying other laboratories which may carry out analyses, whether directly or for purposes of control. (*Diario Oficial*, Nos. 14 and 37, 25 Nov. 1924).

389. **Spain: Organization of the Agricultural and Zootechnical Services.** — In accordance with provisions a decree drafted 20 June 1924, the Spanish Agricultural and Forestry Department includes two sections: (A) Agriculture, (B) Forestry. Section A includes in its turn the following branches: (1) agricultural experiment and instruction, provincial service and phytopathology in relation to agriculture; (2) agricultural improvements and stockbreeding. Section B includes, (1) repopulation; (2) upkeep of forests; (3) protection of wooded property, technical instruction and general questions.

Special articles of the decree deal with the following subjects: Council of agricultural science, agricultural hydraulics service, agricultural pests, research and inspection laboratories, phytopathological inspection, inspection and supervision of the trade in fertilizers, the part taken by the expert staff in agricultural social problems and in agricultural experiments, trade in farm machinery, experimental and demonstration plots, diffusion of agricultural information and propaganda, agricultural publications and charts, technical assistance to agriculture, establishment and management of the regional and provincial offices, encouragement of sericulture, a Central Station for Scientific Agriculture, a farm school for the training of farm managers The establishment of the following stations is also referred to: viticulture, stockbreeding, arboriculture, pomology, rice growing, experimental work in seeds, horticulture and gardening, the agricultural industries, the dairy industry, motorculture, olive cultivation and oil production, plant pathology, sericulture and the rearing of domestic animals, cidermaking, vinedressing and wine making. A special Division for Agricultural Experiment work has been also instituted by means of the special stations which are set up at Almeria, Barcelona, Valencia, Seville and Xeres de la Frontera (*Gaceta de Madrid*, No. 174, 22 June 1924 and Legislative Texts of the International Institute of Agriculture, No. 28, 1924).

390. **Tobacco Cultivation in Spain.** — An extension till 30 December 1925 has been ordered of the term of three years, fixed by the Regulation 30 December 1919 for the experiments in the cultivation of tobacco, and conditions are laid down which are to be binding on agriculturists who propose to undertake the cultivation of tobacco in the Peninsula or in the Balearic Islands. The total quantity of the plants to be cultivated is fixed at 12 million stocks (2000 as the minimum for each grantee); the seed will be distributed, at preferential rates, by the *Comisión central encargada de los ensayos del cultivo del tabaco en España.* Instructions are also given regarding the plantations, premises suitable for drying the leaves and the packing of the dried leaves. Every kg. of the leaves is paid at the rate of 1 to 2.50 pesetas according to quality. Officials and other experts direct and supervise the cultivation. (*Real*

Orden, 27 October 1924; *Gaceta de Madrid*, 23 October and 1 November 1924).

391. **Measures for Reafforestation in Spain.** - R. D. 20 December 1924 (*Gaceta de Madrid*, 23 December 1924).

392. **Spain: Customs Dues on farm tractors and motors.** — In consequence of representations made by the most important firms dealing in agricultural machinery, the Minister of Finances has ruled: (1) that the Royal Decrees of 19 July 1912 and of 6 May 1921 are declared to be in force, authorising the firms mentioned to import motors and tractors in accordance with provision 37 of the Customs tariff, (2) that proof of the use of these machines for agricultural purposes must be given within two years, (3) that within the following five year period, the purchasers of the machine must present an agricultural engineer's certificate similarly attesting the fact of its use in agriculture; (4) that at the time of importation the dealer must guarantee to pay the difference in the customs dues between the preferential rates for machinery for agricultural purposes and those in force if the machines are put to other purposes. (*Real Orden* 23 October 1924).

393. **Spain: Regulations for Remount Stations for Horses.** These regulations relate both to the stations already established, and to those to be set up. They were approved by Royal Decree of 26 December 1024 (*Gaceta de Madrid*, 31 December 1924)

394. **Protection of Insectivorous Birds in Spain.** The value of these birds from the farmer's point of view is recognized and in view of many complaints which have been received from the *Sociedad Protectora de animales y plantas de Cataluña* and from other farmers' associations, an order has been issued, pursuant to the *Ley de Protección* 19 September 1896 and to the International Convention of 19 March 1908, to the effect that the greatest vigilance be exercised to prevent killing in close seasons, etc., and that the dealing in or sale of killed birds together with their transport by railway, is forbidden. (*Real Orden*, 31 October 1924: *Gaceta de Madrid*, 3 November 1924).

395. **Organization of Anti-malarial prophylaxis in Spain.** — A Royal Decree issues instructions under the following heads: declaration of the malarial zones, ad hoc Committees, antimalarial dispensaries, duties of the inhabitants of the infested regions, treatment of malarial waters, dwellings in the marshy areas, prophylactic measures in the large farms, rice cultivation, steeping of textile plants, quinine, rewards and penalties (*Real Decreto*, 13 December 1924, *Gaceta de Madrid*, 13 December 1924)

396. **France: Encouragement of the use of Nitrogenous Fertilisers.** — A decree has been published in the *Journal Officiel* of 25 December 1924, by the terms of which a premium is granted to agriculturists who purchase sulphate of ammonia and also synthetic nitrogenous fertilisers made in France or imported from Germany as payments in kind. It is however understood that such fertilisers are employed by the farmers on the lands they are themselves cultivating or which are cultivated under their direction The premium is reckoned at the rate of 14 centimes per kg. of nitrogen effectively present in the fertiliser. As regards sulphate of ammonia, the content in nitrogen will however be taken as uniformly 20 %. The subsidy at its highest cannot exceed, in one year and for a single cultivator, 400 francs. The premiums are

limited to the following nitrogenous fertilisers: sulphate of ammonia, ammonium chloride, urea, cyanamide and synthetic nitrates. (*Journal Officiel*, 25 December 1924).

A law was subsequently passed on 26 December 1924, setting aside a sum of five million francs to enable farmers to purchase fertilisers.

397. **France: The Cinema for Agricultural Use.** — By a Decree published in the *Journal Officiel* of 16 November 1924 a permanent Committee of 33 members is set up, which is attached to the Ministry of Agriculture and decides on the grants to be made for the preparation and purchase of films, for the installation and working, in the rural communes and in the institutions for instruction in agriculture, of cinematographic apparatus whether fixed or travelling, intended for the diffusion of information useful to farmers and for the necessary propaganda.

398. **Algeria: Measures for checking the spread of *Diaspis pentagona* Targ.** — A decree of 11 December 1924 regulates the importation into Algeria of plants coming from Italy. (*International Institute of Agriculture, Legislative Texts*, No. 33).

399. **Great Britain: Annual Agricultural Returns.** — The annual returns of the acreage of crops number of live stock, etc., afford the only reliable evidence of the dimensions of the agricultural industry, and of the changes from year to year. Information on these points is essential to any proper estimate of the economic conditions of agriculture. The *Agricultural Returns Bill* has been re-introduced into Parliament and passed its Second Reading in the House of Commons on 10 February. This Bill will make the furnishing of agricultural returns compulsory, and so give the Ministry the powers to require these returns which it had under the *Corn Production Act* of 1917. The compulsory powers are needed in order to surmount many practical difficulties that would otherwise prevent the collection of the necessary information in proper time. (*Agricultural Market Report*, Vol. XXII, No. 6, 1925.)

400. **Italy: Supervision and Inspection of the Preparation of Silkworm Seed.** — By Ministerial Decree the supervision and control by an inspectorate of the establishments for the preparation of silkworm seeds, already prescribed in the law of 28 June 1923, has been entrusted to the Royal Silkworm rearing Stations of Ascoli Piceno and Padua, who are responsible for control, either directly through their own technical staff, or exceptionally by employing the staff of the Royal Agricultural Schools and of the travelling lectureships in agriculture or individuals who are recognized experts in the subject. The microscopic examination of selected samples of seeds is effected at the Higher Schools of Agriculture at Milan, Perugia, Portici, in accordance with the provisions of art. 12 of the law cited above.

401. **Italy: Order for Higher Instruction in Agriculture and Veterinary Medicine.** — Royal Decree 30 November 1924 (*Gazzetta Ufficiale* No. 10, 14 January 1925).

402. **Japan: Legislation on Agricultural Tenancy Arbitration.** — This includes: Law No. 18, 23 July 1924, on agricultural tenancy arbitration: Imperial order No. 204, 9 September 1924, amending the organization of the Ministry of Agriculture and Commerce. — Imperial Order No. 205, 9 September 1924 amending the Imperial order in the hierarchy and the salaries of

high officials. – Order of 19 September 1924 of the Ministry of Agriculture and Commerce amending the regulations for the division of the Ministry into sections. – Imperial Order No. 214, 17 September 1924 amending the special organization of Hokkaido. – Imperial Order No. 215, 17 September 1924, amending the organization of the provincial officials. – Imperial Order No. 228, 25 September 1924, fixing the date of the application of the law on agricultural tenancy arbitration and defining the territories on which the law is not to be applicable. (*Kwampô*: 22 July, 10, 12, 18, 26 September 1924 and *International Institute of Agriculture, Legislative Texts*, No. 34).

403. **Luxemburg : The Luxemburg Chamber of Agriculture.** – In the *Memorial du Grand-Duché de Luxembourg* of 3 May 1924 a law is published, setting up vocational Chambers on an elective basis and including Chambers of Agriculture, Crafts, Trade, Private employment and Labour. The Chamber of Agriculture has been set up with the object of founding and, in case of need, of subsidising establishments, institutions, and services of special value to agriculture; of stimulating activity, giving advice, formulating appeals, and obtaining information and statistics in the shortest possible time The Chamber has the right of making proposals to the Government which must be taken into consideration and submitted, should occasion arise, to the Chamber of Deputies. The opinion of the Chamber must also be obtained on all laws and Ministerial and Grand-ducal decrees relating to agriculture or viticulture The Chamber consists of 19 members with full voting powers and 10 substitute members, and five members out of each of these groups must be vinegrowers. In addition there must be two veterinaries, one member of the Government School of Agriculture, and a higher official of the administration of Waters and Forests.

The vinegrowing members form a special permanent Committee. The electorate consists of: (*a*) agriculturists, vinegrowers, stock-breeders, fruit-growers, nursery gardeners, gardeners, who are in active employment, (*b*) former cultivators who have worked for at least 6 years in the district and have no other calling; (*c*) agricultural labourers and workers in vineyards who, at the date of the publication of the electoral lists, have been following their occupation for at least two years.

404. **Holland : Protection of Plants.** – Law establishing provisions for the protection of plants against noxious animals and diseases, in view of the importation and transport of flower bulbs, tubers and dried roots. (*Staatsblad van het Koninkrijk de Nederlanden*, No. 362, 1924).

405. **Portugal : Re-organization of the Ministry of Agriculture.** – Decree of 21 November 1924 (*Diario do Governo*, Series 1, No. 364, 5 November 1924).

406 **Portugal : Measures for the Utilization of Waste Lands.** – Two decrees closely following on each other (*Diario do Governo*, Series I, No. 137, 20 June 1924) lay down the rules and formalities to be observed for the division, utilization and cultivation of the waste lands, and the Commission of *Fomento Agricola* (Agricultural Development) is charged with the work of encouraging and directing such utilization. As waste lands are to be considered, as regards the past, all lands capable of agricultural or forest cultivation and not so cultivated, nor even broken up within the last seven years; as regards the future, lands

of which the cultivation has been neglected for five years, and in any case lands which have not been made use of for any purpose of public utility or which are not assigned to any other purpose by any special law. The Commission referred to has power to proceed to expropriation and to appropriation of these waste lands, and to have the necessary land register entries made: and (*a*) either to cultivate them at its own expense, or conjointly with firms or individual undertakings, or (*b*) to sell or let them for cultivation, or (*c*) to divide them into lots or grant them in emphyteusis. The lots granted in emphyteusis will form indivisible and inalienable holdings, and will become the property of the Commission, without any compensation for the holder in emphyteusis, so soon as he or his lawful heirs either cannot or are unwilling to cultivated the lands themselves. The Commission will be empowered, as opportunity offers, to make experiments in agricultural land settlement, and also to establish experimental fields and to make cultivation tests, either on the lands which it will keep for itself, or on those granted to third parties for cultivation. Sale or renting can only take place in respect of persons who offer the necessary guarantees for breaking up in view of cultivation and undertake to put the land to full agricultural use within four years, sowing the first year and cultivating in each of the subsequent years a quarter of the total area

These two decrees prescribe all the procedure to be followed in applications for division of the lands, expropriations, appropriations, sales, tenancies, agreements for holding in emphyteusis, penalties, etc. etc.

Experiment Stations and Agricultural Instruction.

407. **Germany: Experimental Forestry Institute, Giessen. (Upper Hesse).** – Herr Jörg SCHLOTTERER, assessor for forests and assistant at the above Institute, has published in *Forstwissenschaftliches Centralblatt* (No. 10, 1924) a comprehensive article on the activities of this Institute in forest studies (*Hessische Forstliche Versuchsanstalt*) during the 40 years of its existence. This historical summary is completed by a bibliography of the more important publications issued by the Institute in the period, which have for the most part appeared in the *Allgemeine Forstjagdzeitung*.

408. **Austria: Recent developments of Agricultural Education in Lower Austria.** In Lower Austria there are Agricultural Schools of every kind and grade. In Vienna, which has been for four years an independent State and separate from Lower Austria, there is a higher Agricultural School, which has the power to grant degrees and the graduates of which are entitled to be called Agricultural Engineers There are besides two intermediate and three lower schools (*Ackerbauschulen*) and two winter seasonal courses Among special schools there is a higher school of Veterinary Science, an Academy for Brewery in Vienna itself and schools of Oenology and Cider Making of various grades, and as from 1924 a school for training young men in Agricultural co-operation. In the Higher School of Agriculture at Vienna there is a forestry section and one for the technique of crop growing, there are also a course in milking and various feminine occupations, a training school for teachers of household management and courses for the daughters of peasants. In addition to the schools which are provided out of public funds there is also a group of schools

maintained by Associations or private persons. It is a satisfactory feature that the attendance at all these schools is very large, and more particularly that the number of sons of farmers who return to the home farms after having passed through the schools is continually on the increase, in contrast to what happened before, when boys who had passed through the schools and were conscious that they were well educated would not apply for employment on farms but for other posts on the railways or in the Post Office. As in these last few years the demand for education for sons and daughters of farmers has much increased, the schools now in existence are no longer adequate. In particular there are on the small farms boys who are desirous of further education but who have not the time to attend for the whole winter at school nor money to live for so long a time away from home and to pay for board in the places where schools are to be found.

The Lower Austrian Chamber of Agriculture with the intention of meeting these pressing requirements and in agreement with the local Government have organised a series of courses completed in their turn by other quite short courses (one or more days) relating to some special branch of instruction Such courses are intended, for example for the managers of co-operative dairies (four day's course), or deal with the management of pasture land (eight to fourteen days), with wine making (three to fourteen days), land clearance (one day), wine grafting (one day), vine growing in general (two weeks in spring, three days in summer and five days in autumn), keeping of vine growers books (one day) fruit growing (two to five days) and grafting of fruit trees (one day), tree planting (three weeks in spring, one in summer and one in autumn), fruit growing along the roads (three days), fruit growing for elementary teachers (eight days), preserving of fruit and vegetables for women, dairy industries for daughters of peasants, handling of seeds, control measures against weeds, book-keeping, etc., etc.

All these courses are naturally conducted with due regard to local needs and the interests of those who attend them. As a completely new organisation courses were established in the Autumn of 1924, after experiments in the previous winter with great success. These were arranged to cover four months and intended for the sons and daughters of farmers in 32 places where there had been so far no agricultural schools. The purpose of these courses was not to displace but only to replace the winter courses. Ten to 12 hours of instruction are given weekly on two days or three half days As a rule no evening instruction is given. The course for men includes business correspondence, arithmetic, natural history, history, agriculture, fruit growing, cattle breeding, cheese making, elements of law and of fiscal requirements, book-keeping, co-operation, and where desirable, the management of Alpine farms, wine growing and sylviculture. The subjects in the womens' courses include citizenship, natural history, dietetics, household management, arithmetic and book-keeping, together with stock breeding and cheese making, vegetable growing, first aid to live stock and hygiene. Besides the lessons, various kinds of practical work are arranged, surveying charts are examined, field visits paid and excursions taken. As regards the scope of the curriculum and the funds for the purpose, instructions are issued by the Lower Austrian Chamber of Agriculture, which also meets the expenditure for teachers' services. In any case admission is to be confined to at most 30 men and 16 women over 16 years of age, and every student admitted must pay a fee of 100,000 crowns. The expenses of maintenance, lighting, heating, etc., are met by the District Chamber of Agriculture. The regional Chamber of Agriculture exercises the final supervision over the courses. The teachers receive 15,000 crowns for every hour of instruction they give and half that sum for every hour of practical demonstration work. At the end of the course a certificate is granted to the students who show that they have benefited by attendance.

Other useful aids to agricultural instruction are the lectures given on the occasion of the "agricultural week" and "the agricultural sample fair" in connection with the "Vienna Fair". The "agricultural week", which for two years past has been held in May by the Lower Austrian Chamber of Agriculture, is divided into sessions which cover different aspects of agricultural activity. Various questions of immediate importance are also handled in a popular form each day at the Exhibition itself.

Instruction in agriculture is also given to soldiers who are anxious to take up work in the country later, and for this purpose farms are in existence under the special management of military experts in agriculture.

With the object of providing elementary teachers with the opportunity of gaining a fuller grasp of agricultural questions a course is held for rural teachers at Mistelbach, attended in all by 175 schoolmasters.

In order to secure a flow of properly qualified labour to the country, coming if need be from the towns, the "Apprentices" Employment Bureau (*Lehrlingsstelle*) was founded in 1920 and taken over by the regional Chamber of Agriculture in 1923. The impulse to this foundation was given by the pamphlet of GESZMANN "Back to the Land" (*Zuruck zur Scholle*) The essential qualifications for registration are as follows: the boys should have attended the elementary school, be physically fit and show interest in country life, and must be bound to farmers who board them and initiate them into farm work. In the probationary year the boy receives a small amount of pocket money, his food and a change of clothes and linen When the year is over he receives some clothes, and in the two following years, a larger sum of money and an outfit. A short examination is held at the end of the apprenticeship, and a certificate is given to each boy.

The boy's employer must pay every month to the Employment Bureau, for the first year 10,000 crowns, for the second, 15,000 crowns, and for the third, 20,000: these payments go to meet the office expenses and the Office is responsible for the supervision of the boys during the whole period

The results of this institution have been very satisfactory on the whole for farmers, but from October 1923 the number of apprendices has been decreasing which is to be explained by the poor prospects they have of obtaining the better posts.

The various agricultural periodicals naturally give every support and encouragement to the instruction in agriculture in Lower Austria, in particular the *Mitteilungen des Landeswirtschaftskammer in Wien* which from January 1925 is appearing in an enlarged form under the title "Landwirtschaft". ("Bauernbündler" *Mitteilungen der Landes-Landwirtschaftkammer*, 1 Dec. 1924, Vienna: Programm zur Ausgestaltung des ländlichen Fortbildungsschulwesens: *Ministry for Public Worship and Education*. Vienna, 1916: Publications of the "Landes-Landwirtschaftskammer" of Vienna: GESZMANN. Zurück zur Scholle. Vienna, 1919: Die agrarische Woche der Landwirtschaftskammer, 19-23 May 1924, Vienna, 1924).

409. **Austria: Demonstration Farms attached to the Vienna Higher School of Agriculture.** — In this school students had until lately no opportunity for visiting farms in company with their lecturers as a regular part of their studies, with the object of gaining a knowledge of farm work and of the conditions under which the various crops are grown Practical work in the vacations suffers from want of the guidance of theory, as at those times the student is working without his tutor and often without any scientific direction. The Vienna school has accordingly made an arrangement with six farms of varying size and in different localities, including one belonging to Dr. HAINISCH, the president of the Republic, by which the farms are placed at the disposal of the school for demonstration purposes Other farm holdings, with good agricultural industrial equipment are to be incorporated with the School for the same purpose The farms remain in the full possession of the owner, who does not receive any remuneration from the School, and are to be used by the School only for the objects stated They may accordingly be visited at any time and examined in detail by the students under the guidance of their teachers and thus it is possible for them to make a real study of farming methods. Such frequent visits facilitate the preparation at the School of farm maps, statistical tables and graphs, which may be shown, with the help of lantern slides, and discussed profitably before any excursion takes place

A body of rules are compiled for these farms of which the principal points are as follows: demonstration farms must not be either model nor experimental farms, they must be farms actually working at a profit with the sole object of allowing a closer touch of the School with practical work and of enabling visits to be made by the students to farms which can first be studied in every detail by the teaching staff These farms must at the same time by their special characteristics which are the outcome of local conditions, be well adapted for the teaching and research work, as well as the practical utilization of the results of the new enquiries A farm selected for demonstration purposes must not on that account be required to incur any special expenses The owner must allow both the teaching staff and students accompanied by a lecturer access at all times to all parts of the farm, and also the inspection of the farm books, on the understanding that the cash register is excepted The School may however, if owners are willing to undertake to show their accounts weekly and thus make perfectly clear their system of book-keeping, declare its readiness to keep the books without charge and to close the account at the end of the year. The owner is not compelled to undertake special crops. On request the staff of the School give him the benefit of all their observations, and supply him with their opinion on technical or economic questions. The owner may, whenever he so wishes, withdraw his farm from the list of those attached to the School and the arrangement may also be cancelled on the death of the owner, or when the farm is sold or let. For its own part the School may demand the dissolution of the agreement.

For carrying out the work involved in this new scheme a special Institute was set up at the Higher School (*Institut für landwirtschaftliche Demonstrationswirtschaften*), to be used jointly by all the departments, with the function of co-ordinating the various programmes of scientific research and the proper utilization of the demonstration farms, and of effecting and maintaining the connection between them and the Higher School. (W. SEDLMAYR V. Landwirtschaftliche Demonstrationswirtschaften der Hochschule für Bodenkultur. *Wiener landwirtschaftl. Zeitung*, No. 74, No. 6032, 1924, KALLBRUNNER, Demonstrationswirtschaften der Hochschule für Bodenkultur, *Neue Freie Presse*, No. 21681 : 1925.)

410. **Brazil: Experimental Cultivation of Wheat in the "Patronatos Agricolas" of Rio Grande do Sul.** — The Director of the Patronato Agricola (Farm Settlement) known as " Visconde de Craca " in Rio Grande do Sul, has forwarded to the Minister of Agriculture samples of American wheat, variety " 448 " and " 142 " cultivated on the Estate experimentally. These varieties originally came from the Experiment Stations of " Estanzuela " in Uruguay and " Ponta Grossa " in Paraguay; they were sown on 24 June and reaped from 10 to 15 December of the past year, and gave excellent crops

On the same *Patronato* very satisfactory experiments were carried out in the cultivation of white oats. (*Brasil-Ferro-Carril*: No XVI, Vol XXVIII, No. 382, 1925).

411. **Brazil : Experiment Stations for Cotton Growing in the State of Sergipe.** — The Government of this State is continuing the organization of the Cotton Service, five experiment stations having been already installed, situated respectively in the capital and in the communes of Dores, Propria, Estancia and Sao Paulo. On these stations' Day's pedigree cotton which is derived from " Russell Big Boll ", has been planted on a large scale. Experiments have also been made with other varieties, especially in the Central Station, and there are thus under observation specimens both of American and Brazilian cotton In the station in the capital, which is also the headquarters of the Service, there is a machine plant driven by electric power. Special attention is paid to the grading of the fibre, and the Government of Sergipe requires that all cotton grown in the State and passing into the warehouses shall be graded by the staff of the Cotton Service. Twenty five thousand bales (of 60 to 70 kg.) of the 1923 crop were so graded, that is about 54 % of the total production. The main warehouses are at Aracaju, Larajeira, Riachuele and Maroim. (*Brazil-Ferro-Carril*, year XVI, Vol. XXVIII, No 379, 1924).

412. **Denmark : The Botanic Garden, Copenhagen.** — Prof. OSTENFELD has prepared, as a jubilee publication in commemoration of the fiftieth anniversary of the foundation of this Danish institution (1874-1924), an account of the history and resources of the Botanic Garden, Copenhagen.

The present garden is the successor of one that dated back to the close of the eighteenth century and had become inadequate. In 1874 about twenty-four acres were transformed to meet new requirements. In recent years the trees have been collected into a special arboretum at Sorö, and space for special sections was thus provided. The extensive glasshouses in a compact block of more than 2000 square metres include the higher palm-houses and lower ranges where tropical plants, orchids, aquatics and other groups are housed. The Museum contains a mass of material, including special Danish, Arctic, and West

Indian collections. The library of 25 000 volumes has been enriched by numerous donations.

During the past fifty years the garden has been directed by Joh. LANGE, F. DIDRICHSEN, E. WARMING (1885-1911), and C. RAUNKIAER, who was succeeded last year by C. HANSEN OSTERFELD. The staff lists include such well known botanists as W. JOHANNSEN, L. KOLDERUP, ROSENVINGE, F. BORGESEN and many others. Copenhagen has many advantages as a centre for the study of the northern flora, and the monograph of Prof. Ostenfeld, with its abundant information and illustrations, will prove a useful book of reference. (C. H. OSTENFELD, Botanisk Have gennen 50 Aar 1874-1924, pp. 101. Copenhagen, 1924 : *Nature*, Vol. 115, No. 2884, 1925).

413. **Denmark : Competition of the Danish and Icelandic Fishing Industries.** — The Section of Technical Chemistry of the *Polyteknisk Lårennstalt* in Copenhagen has announced a prize competition, intended to encourage the discovery of new and improved technical methods for the utilization of products of the fishing industry in Denmark and Iceland. The prize is fixed at 4,000 crowns and exhibits for competition may be sent to the Danish Polytechnic not later than 1 November 1926 (*Chemiker Zeitung*, year 48, No. 149, 1924).

414. **Spain : Intensive Course in Viticulture at Pamplona.** — This short course was held from 12 to 13 January 1925 at the School for foremen and managers in vine-growing and wine making at Pamplona, accompanied by tests in pruning and vine grafting. The lectures and practical exercises dealt withs the following subjects: (1) land for plantations, American vines, grafts, grapes, must; (2) trade analysis of wine, elements to be determined in the analyses sample taking, preliminary operations, simple testing or organoleptic examination, microscopic examination, products required in the cellar, preparation of the solutions : (3) the cellar and its equipment, necessary cleansing and preparation, vats for fermentation, their size, fermentation of the must, stripping of the grapes, ferments, conditions for fermentation, slow fermentation, preservation of the wine, description and causes of diseases and treatment, special operations, (4) defects and diseases of wine, description and causes of diseases and treatment: wine tasting, utilization of the residues of wine-making, distillation, alcohols, brandy and liquors, tartar, the more usual adulterations of wine and their recognition, oenological legislation, legal procedure in regard to the wine-making, industry, (5) correction of wine, blending and questions relating thereto ; graphic solution of such problems, fine red wines, special white wines, sparkling wines, sweet wines and liquors, " mistelas ", tonic wines.

Each of these five lectures was followed by practical laboratory and field exercises.

The first, third and fifth lecture, besides others on wine grafting and pruning, were given by the agricultural expert N. G. DE LOS SALMONES, Director of the School : the second and fourth by Professor F. J. CUENDE. Practical work is under the supervision of Professor D. A. GARCIA, late of the Station of Winegrowing and Oenology. Certificates of attendance at the course are granted to students. (*El Progreso agricola y Pecuario*, Year XXXI, No. 1374, 1925).

415. **United States : The Boyce Thompson Institute for Plant-Research, Yonkers, N. Y.** — This Institute was founded by the mining engineer, Colonel WILLIAM BOYCE THOMPSON, and was opened at the end of September

1924. It is to form as it were a universe in miniature for the plants under experiment, in which the environment with which nature supplies plants will be the result of art and these environmental conditions will be regulated by botanists and physiologists by means of elaborate machinery. Thus, since plants respond to changes in temperature, automatic services control the temperature in the rooms and greenhouses : since plants behave differently under different intensities and colours of light, and with differing lengths of day, the light of the sun will be modified or replaced by colour screens and large groups of thousand-watt lamps ; plants must have carbon dioxide from the air, and generators make it possible to supply this gas in any concentration desired, etc. The Boyce Thompson Institute is the result of co-operation between many students and technicians A kind of Consultative Committee is composed of Prof. J. M. COULTER, head of the Botany Department of the University of Chicago ; Prof. L R JONES, head of the Department of Plant Pathology at the University of Wisconsin, Dr R F. BACON, formerly Director of the Mellon Institute of Industrial Research The active head of the Institute and director of research is Dr W. CROCKER, formerly in charge of Plant Physiology at the University of Chicago (*Science*, N. S., Vol LX, No. 1553, 1924).

416. **United States : An Important Bequest for Research in Agricultural Chemistry.** — The entire fortune of five million dollars, which belonged to the widow of HERMAN FRASCH who died 24 September 1924, at Paris, has been left for research work in agricultural chemistry, in fulfilment of the wishes of the testator FRASCH, who expressed in his will the hope that results of real practical utility would accrue The United States Trust Company, which is executor for the bequest, will propose for this foundation, by arrangement with the *American Chemical Society*, one or several of the institutions of the United States

417. **France : Popular Courses in Agriculture at Paris.** — These courses are given in connection with the *Conservatoire des Arts et Metiers* The syllabus is in two parts, as follows :

1. Agriculture and general biology ; 2. Special agriculture and biology. In the first section the following subjects are developed · (*a*) ***agrotechnology*** (agricultural soil science, biological foundations of agricultural science) ; (*b*) *general phytotechnology* (plant nutrition in relation to agriculture, biological explanations of cultural practice) , (*c*) *general zootechnology* (animal nutrition in relation to breeding, feeding of live stock, production of milk and of meat).

In the second section the following subjects are treated : (*a*) *phytotechnology as applied to industry* (industrial plants, including the most important colonial species, together with a study of the production connected with each : textile, oil-yielding and resinous plants, plants yielding tannin, perfumes, rubber and essences) : (*b*) ***zootechnology*** applied to industry (animals yielding silk, silks, production of wool)

The leading principles of agricultural mechanics are taught during the study of practical cultivation and of the special kinds of cultivation. The lectures given in the lecture theatre are supplemented by practical lessons, laboratory demonstrations and practice, excursions, etc.

418. **France : Farm School for the Re-education of Disabled Men.** — This school was established some years ago by the municipality of Nantes, at

Chateau-Thébaud (Loire inférieure), and continues to take in without charge disabled men of all classes who wish to build up a position in the country. It is especially intended for those suffering from lung wounds or gassing, for whom an open air life is beneficial or essential. The course fits them for posts as farm managers, foremen, gardeners, watchmen, shepherds, poultry-keepers, farmers, and breeders of farmyard animals Daily practical work on the farm is arranged in addition to the courses held in agriculture and stock-breeding. The course lasts for one year, and a certificate of proficiency is given to students who benefit by the course. (*Journal d'agriculture pratique*, year 88, No. 41, 1924).

419. **France : Agricultural School for Girls at Belleville.** — This school was founded in 1919 by Mlle. Thome who bought for the purpose a very large property known in the district by the name of Chateau de Belleville and situated in the valley of Chevreuse (commune of Gomet le Châtel, Seine et Oise). It includes large and well equipped buildings, a model farm, a dairy, a number of farm animals, a large park, an orchard and about 25 hectares of land used for field crops. Girls are admitted from the age of 17. The complete course lasts 10 months and includes: household management, general hygiene, agriculture, horticulture and gardening, arboriculture, stock-breeding, dairying, poultry-keeping, bee-keeping, rural economy ordinary and agricultural law Professors of the schools of Grignon, Alfort, of the *Institut agronomique* and of various others visit regularly each week to give lessons in theory, followed by practical applications, while the resident professors are responsible for the proper performance of the work whether in the farmhouse, on the farm or in the garden, in which the students take part during the intervals between the courses. During the year visits are organized to model farms, to shows and to large establishments

The advantages of this valuable institution are extended by Mlle Thome to girls who are war orphans who are selected from the age of 13 and receive a two years training course in domestic and farm work (S. Mottet L'ecole féminine d'agriculture de Belleville *La vie agricole et rurale*, Year 14, Vol XXVI, No. 3, 1925)

420. **France : Technical Courses in Butchery at Angers.** — These have been established to give technical instruction to workmen and apprentices in the butchery trade. They last three years and deal with theory as well as practice They offer a complete scheme of instruction and cover all technical questions connected with butchering and the sale of meat (*Journal de la Boucherie* quoted in the "*Revue générale du froid*", year 5, No. 12, 1924-25)

421. **Great Britain : Report of the Colonial Research Committee for 1923.** — The Report draws attention to the geological investigations in the Leeward and Windward Islands , to the researches on the Panama disease of bananas ; the re-discovery of deposits of tin in British Honduras, which were known to the Spaniards but have been forgotten In Nyasaland the investigation of the Sumbu coalfield has given encouraging results ; a steam trial with a large tractor was entirely successful ; the area of the coalfield is estimated at 150 sq miles. The investigation of sponges in the Bahamas has disclosed the breeding seasons of six types known to the sponge market. (*Tropical Agriculture*, Vol 1, No. 11, p. 173. Trinidad, 1924.)

422. **Great Britain: The Imperial College of Tropical Agriculture.** — The College was opened two years ago to train students intending to become tropical planters, agricultural administrators or officers or specialists in tropical agriculture. An important feature of the College is the provision for research and investigation. The experimental laboratories and plots are situated at St. Augustine, seven miles from Port-of-Spain in the Island of Trinidad. There are seven professors of zoology and entomology, mycology and bacteriology, botany and genetics, chemistry and soil science, agriculture, economics, and sugar technology, and four lecturers, including one in veterinary science. The ordinary diploma course covers three years. Fourth year courses are provided for specialization in branches of agricultural science or chemical technology, in particular in sugar technology. (*Nature*, Vol. 115, No. 2884, 1925).

423. **British India: Agricultural Experiment Institute at Indore, Central India.** — This Institute was inaugurated on 24 November 1924, and special attention will be given to the growing of cotton. The foundation of this Institute was made possible by the grant by the Indore Durbar of a holding of 300 acres and the grant by the *Indian Central Cotton Committee* of two *laks* of rupees (about £ 15,000 sterling) for the expenses of establishment, in addition to an annual contribution of 120,800 rupees (more than £ 9000 sterling) for the current expenses, there being also a certain return from the land itself. The payment of the annual contribution will be divided between the *Indian Central Cotton Committee* and the eight states of Central India.

The direction of the Institute is entrusted to a body of six members under the presidency of the delegate of the Governor General of Central India. Among these members are nominees from the *Indian Central Cotton Committee*, one of the State of Indore and two of the other contributing States (Dhar, Jaera, Datia, Rutlam, Dewas, Senior Branch, Narsingharh and Sitaman).

The Director of the Institute will act as agricultural adviser to the above named States. The experimental area, granted by the Durbar of Indore to the Institute for 99 years, includes all the varieties of soil that are suitable for growing cotton and which are to be found in India, and is very favourably situated for research work on the cultivation of this plant. It is close to the City of Indore, which is rapidly developing at present as a commercial, industrial and intellectual centre. The Institute will have to form a library so as to be kept up to date as regards the agricultural production of the region, and will be expected to train students who have taken their degrees elsewhere and have been selected by the *Indian Cetral Cotton Committee*. As director there has been appointed Mr. A. HOWARD C. I. E., who has already filled the post of *Imperial Economic Botanist* to the Institute of Agricultural Research at Pusa and the wife of the Director is to be the *Physiological Botanist*, having previously held the position of Second Imperial Economic Botanist at Pusa (Communication received at the International Institute of Agriculture).

424. **Experimental Work in Agriculture in Tanganyika Territory.** — The attention of the Agricultural Department of the Territory continues to be mainly devoted to cotton, in which a gratifying increase in production has been shown. Special attention has been given to the development of the native coffee industry in the Moshi District and to the introduction of ploughing

among the cattle-owning natives in the Shinyanga sub-district of Tabora. The long-established custom in this district had been hand-cultivation by women, but the tribal organisation of the natives lent itself very readily to an organisation of cotton cultivation by communities, the contributory factors being a closely settled population with marked pastoral and agricultural aptitudes, a docile and hardy type of cattle, and large tracts of fertile open soil free from tsetse fly. A station was established for the training of oxen, the instruction of natives in ploughing, as well as for demonstration and the testing of different types of ploughs. Twenty-five ploughs were purchased and issued to native villages which are to repay the cost from the proceeds of the communal crop sold on markets conducted by the Department over a period of two years. The result was the ploughing of 500 acres of land which were under cotton in 1924, and a request by the council of native chiefs for the supply of 320 additional ploughs, on the same terms of repayment.

Other activities of the Department have been concerned with the general agriculture of the Territory, including experimental work at its stations.

The Botanic Gardens at Dar es Salaam have been reorganized, and large consignments of seeds and planting material have been received from botanical stations outside the Territory. An experimental fruit orchard has been established including many Hawaiian and local varieties of tropical fruits. (*Department of Agriculture, Tanganyika Territory, Report for the Fifteen Months ending March 31st* 1924 : 36 pp in 4°, London, 1924)

425. **West Indies: Sugar Cane Experiments at Ste. Madeleine, Trinidad.** —The Ste. Madeleine sugar company has issued its first report, for the year 1923-1924. The report consists of two parts · (1) Experiments with varieties of sugar-cane; (2) Manurial experiments with sugar-cane. The investigations are being carried out on useful lines and those in charge are to be commended on the start made to solve field problems (*Tropical Agriculture*, Vol. 1, No. 11 Trinidad, 1924)

426. **Rubber Research in Malaya.** — The Secretary of State for the British Colonies has sanctioned the establishment in Malaya of a Rubber Research Institute, to co-ordinate and extend the work hitherto carried out by the Rubber Grower's Association, private estates and the Government Agricultural Department The work of the Institute will be guided by its own board of directors. (*India Rubber Journal*, Vol LXIX, No 2, London, 1925)

427. **Italy: The Largest Ear of Wheat Grown.** — On the suggestion of the Bacteriological Experiment Station at Crema, there has been recently formed a National Committee of Propaganda for Improving the Cultivation of Wheat (*Comitato Nazionale di azione e propaganda per migliorare la coltura del Frumento*). In the present year 30 hectares of land have already been cultivated experimentally for this purpose and the wheat has been transplanted, after sowing in the seedbed, the plants planted 50 cm. apart and given plenty of fertiliser. Very satisfactory results have been obtained in the competition announced by the Crema Station last year for the largest ear of wheat and the largest wheat plant in Italy, and the Committee hope to obtain still better results. Professor A. VIVENZA, Director of the Royal Higher Agricultural Institute at Perugia is said to have raised a plant containing 342 ears. (*Comitato Nazionale Coltura del frumento*. Milan, 1925).

428. **Formation of Special Administrative Committees for the Royal Agricultural Stations in Italy.** — Special Committees are placed in charge of the administrative side of these Experiment Institutes. No change is made in their composition as regards the provisions already fixed by the various foundation decrees or the regulations. This applies to the Royal Stations for the cultivation of citrus and other fruits (Acireale), silkworm breading and the cultivation of mulberry trees (Ascoli-Piceno), experimental agriculture (Modena), experimental silkworm breeding (Padua), experimental cereal cultivation (Rieti), experimental sugar beet growing (Rovigo), the laboratory of cryptogamic botany at Pavia and the Royal Station of experimental agricultural chemistry at Turin. By the Royal Decree of 28 August 1924, however, a constitution was proposed for the Administrative Committees of the Royal Experimental Oenological Station at Asti, of the Royal Station of Agricultural Entomology at Florence, of the Royal Station of Vegetable Pathology at Rome and of the Royal Station of Experimental Agricultural Chemistry at Rome. (*Gazzetta Ufficiale*, 4 December 1924).

429. **Italy: Courses for Rural Mechanics at Rome.** — On 2 April 1925 there was inaugurated at Rome (at Capannelle) by the Ministry of National Economy with the support of the *Opera nazionale per i combattenti*, a three months course for rural mechanics, intended to train workmen skilled in handling and repairing farm traction and stationary machines. The course is divided into three periods. In the first period of 15 days lessons are given on the elements of physics and mechanics and on the technology of machines (the lathe, the drill, the polishing wheel, welding iron), and practical instruction is given (adjustments, forging of parts, turning, tin soldering and autogenous welding) In the second period of 45 days instruction is given in the elements of agricultural science in connection with the functions, use and output of agricultural machinery, the economic advantages and the selection of machines, the construction and working of the various types of machines for cultivation (ploughs, harrows, etc). On the practical side the students learn the working of the machines, the mounting, unmounting and exchange of parts, use of speed registers and repairs In the third period of a month, the theoretical part of the course deals with the farm motor tractor, and the practical work consists in the use and keeping in repair of the tractor and in ploughing exercises and practice in coupling the tractors and working with farm machinery, both stationary and mobile.

Further information on the school may be obtained from the *Opera Nazionale per i Combattenti, Sezione economico-sociale*, Via Ulpiano, 11, Rome.

430. **Japan: Forestry Instruction.** — The Japanese have brought to a high pitch of perfection the professional training of technical experts for the work of managing the State forests. At the present time, the number of Japanese forestry officers is about 2,700, of whom more than 500 are university graduates. The first institution for higher instruction in sylviculture was opened at Komaba, five kilometres from Tokio, in 1881, and in 1805 it was affiliated to the University. There is a large teaching staff, and the forestry subjects proper are in the hands of six professors. The School has the entire management of a vast forest estate of 160,000 hectares which extends through the whole of Japanese territory and is eminently suited for the practical

training of the students, while forestry engineers, after completing the theoretical course, must work on these forests for three months.

Other forestry schools have recently been opened and also attached to a University: viz. in 1907 one at Sapporo for the Yeso, in 1922 one at Kiusiu, and in 1924 one at Kioto. In addition to these four institutes for higher instruction, Japan has six Forestry Academies. The Government assists professors and students by grants of funds for further training in other countries. Nearly 350 professors are at the present time making use of these facilities.

The Japanese Government has also established a station for forestry experiments, which has been at work for some time at Tokio and to which two sub-stations have recently been added, at Sendai and at Kumamoto. The enquiries carried out by these institutes relate to: (*a*) Re-afforestation and soil investigation; (*b*) utilization of forest products; (*c*) maintenance of forests; (*d*) protection of forests; (*e*) forestry meteorology; (*f*) questions of forest pasturages; (*g*) forest sowing.

The results of the numerous experiments already made by the Tokio station have appeared in a Japanese periodical in English with the title " Journal of the Forest Experiment Station ". (*Journal Forestier Suisse*, Year 75, Nos. 7-8, 1924).

431. **Paraguay: Foundation of an Agricultural and Stock-breeding School in Paraguay.** — The establishment of this School was authorized by a law of 11 September 1924, and its headquarters are to be at the Paraguayan Botanic Garden (*Diario Official*, No. 1958, 18 September 1924).

432. **Sumatra: The General Experiment Station of the General Association of Rubber Planters of the East Coast of Sumatra.** — In the Proceedings the Experiment Station of this Association, No. 18 of the General Series, a report is published by the Director of the Station, Dr A. W. K. DE JONG on the work of the Station for the period 1 July 1923 to 30 June 1924. The Station consists of an administrative office, three sections, of chemistry, botany and agricultural science respectively and the Experimental Garden of Soengei Pantjoor has been attached. The report contains various chapters referring in order to the various branches of the work of the Station. With regard to the Chemical Section, under MM. H. N BLOMMENDAL and W. BERTELS, the figures show the amount of work done in the period. In all 1307 different specimens were examined and analysed, including rubber, latex, bisulphate of soda, anticoagulants, derivatives of coal-tar, palm oil, water, soils etc. The Botanic Section under Dr. C. HEUSSER is mainly interested in the selection of varieties of Hevea and phytopathological questions, while the Section of Agricultural Science, under MM. I. A. MAAS and I. F SCHMOLE, besides dealing with Hevea and the oil-yielding palms, carries out experiments on tea, coffee, forage plants, fertilizers, plants yielding essences, etc. (Verslag van den Directeur van het Algemeen Proefstation der A.V.R.O.S.: 1 July 1923-30 June 1924. *Mededeel v h. algem. Proefst. der A.V.R.O.S.* General Series, No. 18: 15 pp, 2 tables, Printed by Deli courant. Medan, 1924).

433. **Switzerland: Swiss Experimental Institute for fruit-growing, vine-growing and horticulture in Wädenswil.** — The Director of the Institute, Prof. Dr H. MULLER, THURGAU, has arranged for the publication of a detailed report on the work of the Institute for the initial period

1921-23. In addition to the general summary there are separate chapters dealing with the work accomplished by the Section of Physiology and Vegetable Pathology, the Section of the Bacteriology and Physiology of Fermentation, the Chemical Section and the Technical Section. The latter Section deals respectively with vine-growing, pomology and horticulture. The report contains a considerable amount of information and statistical matter which together with the large number of special courses held by the Institute and the publications of the scientific staff are evidence of the very marked activity displayed by the Institute in the period under consideration. (Bericht der Schweizerischen Versuchsanstalt für Obst-, Wein- und Gartenbau in Wädenswil für die Jahre 1921-1923. *Landwirtschaftliches Jahrbuch der Schweiz*, Year 38. Part 5: 1924).

434. **Federal Station of Viticultural Experiments in Lausanne and the Pully Estate.** — The work of this Station is described in a report by the Director, Dr H. FAES and his Assistant M. P. TONDUZ under the following heads: (*a*) the Division of Physiology and Vegetable Pathology; (*b*) the Division of Chemistry and Bacteriology; (*c*) the Secretariate; (*d*) the Pully Estate. As regards division (*a*) reference is made to grafts and grafting stocks of vines, hybrid direct producers, and work on vines with black grapes: this work is done in collaboration with the Viticultural Station at Mezzana, since these wines are the type specially recommended for the Ticino region. The activity of this Division is also displayed in the control measures and the experimental work undertaken in respect of the various diseases of wines and the diseases or parasites of fruit frees, thus carrying on the pomological work of the former Waldensian Cantonal Station.

The Division of Chemistry and Bacteriology has been very active on behalf of the service of information, having carried out at its request altogether 345 analyses of damaged wines and ciders A large number of analyses were made in connection with waldensian wines of the 1922 vintage, some, for purposes of special studies, on the must of grafting stocks (358 analyses in 1923), 305 on soils, on wines coming direct from the producer, on materials used in wine-making, on Ticino wines, sprays and insecticides, etc. The Bacteriological Section has continued its investigations into the diseases of wines and ciders, has undertaken experiments for the destruction of bats and rats, and in collaboration with the Division of Plant Physiology and Pathology has made a study of the action of benzoate of soda as an antiseptic, etc. In addition, as regards laboratory and technical work the staff of the Chemical and Bacteriological Division have devoted considerable time to the establishment and carrying out of short courses in wine-making, reparation of alcohol free wines, utilization of fruit, handling of the vintage and cider-making.

The report also deals in a special chapter with the research work undertaken on the Pully Estate. (*Annuaire agricole de la Suisse*. Year 25, Part 4, 1924.)

435. **Switzerland: Federal Experimental Seed Testing Institute in Lausanne, Monte Calme.** — A report on the work of this Institute in 1923 has been published by the Director, Dr. G. MARTINET. The number of analyses undertaken was 4,394 besides 763 carried out in connection with the work of seed selection. The Association of Seed Testers in Switzerland (*Association*

suisse des sélectionneurs, Syndicate des sélectionneurs fribourgeois de Sarine, Glâne et Broye, Syndicats des sélectionneurs du Jura Bernois) and the *Bureau des semences d'elite* have had 119 510 kg. of seed in all tested by the Institute. The report gives a considerable amount of information for the work of selection both in the experimental field and in the case of cereal seeds forage crops and other food plants on the farms themselves. There are also notices of tests carried out with various fungicides (" Uspulun " " Fertilisa de Pion-Gan ") and powdered carbonate of copper and of tests carried out to check rot in wheat, etc. The Institute has also established a close and valuable cooperation with farmers for the cultivation of potatoes with a view to selection. (*Annuaire agricole de la Suisse*, Year 25, part 5, 1924).

436. **Federal Institute for Agricultural Chemistry at Lausanne.** — An account of the work of this Institute during the years 1922-23 has been published by the chief officer, M. C. DUSSERRE. The number of specimens received and analysed was in all 5585, 2340 in 1922, and 3245 in 1923, and as the number in 1921 was 2200, there has been a progressive increase in the testing work following on the increased quantity of the material in use, which in its turn reached and even in the case of certain substances exceeded the pre-war quantities. The quantity of samples of fertilizers was in all 16046 100 kg. for 1922 and 247 6 700 kg. for 1923, and the increase was particularly marked in the case of the phosphatic fertilisers As regards forage crops the number of specimens received during the two years were respectively 368 an 416 for an amount in each case of 1 600 500 kg. and 1 794 300 kg. The report contains valuable notes on the various tests carried out on these substances and on crop specimens, spraying materials, and soils. A note is given on experiments in weed destruction the use of " Phosphazote " for selected cereals and of nitrogenous fertilizers for potatoes as well as of fertilizing material for meadows and pastures. A special report is promised on the fertilizer tests carried out in the *Croisettes* experimental field. (*Annuaire agricole de la Suisse*, Year 25, part 30, 1924).

437. **Courses in Agricultural Book-keeping at Brugg, Aargau.** — Three day courses have been held in Germany and in France in February of this year. Students receive board and lodging free of charge and railway travelling expenses are refunded. In return they undertake to keep the accounts of their farm for at least a year under the supervision and direction of the *Secrétariat des paysans suisses*, and at the end of the year to submit their farm books to the Secretariat. Boys working under the orders of the head of the family are not admitted to the courses, unless the head of the family has made them thoroughly acquainted with all the work of the farm and in particular with the details of the accounts Candidates must have secured the co-operation of the farm housewife as account must be taken of the produce consumed by the family ; tenants are not to be taken into consideration, unless they are in a position to supply an exact account of the value of the land, buildings, etc. The secretariate pledges itself not to disclose the name under which the accounts are kept. Diplomas and prizes are awarded to those who show the best account books. (*L'industrie laitière suisse*, Year 6, No. 1. Brugg, 1925).

438. **Czechoslovakia : Agricultural Instruction.** — An official publication of the Czechoslovakian Ministry of Agriculture supplies the following

pupils and 301 popular agricultural schools with 14,117 pupils. In addition the farmers' organizations are responsible for the establishment of the rural popular University, the agricultural Museum, the organization of agricultural shows, etc. The administration of the schools of intermediate and lower grade rests with the Ministry of Agriculture. (*Publication du Ministère de l'Agriculture de la République Tchécoslovaque*, 1 August, 1924.

439. **Czecoslovakia: Agricultural Academy.** — The institution has been recently founded at Prague, on the initiative of Prof. STOKLASA, for the purpose of encouraging scientific experiment in the field of agriculture, forestry and the agricultural chemical industry. It is divided into six sections. At the present time the Minister of Agriculture, Dr. MILAN HODZA, is the president of the Academy, and Prof. STOKLASA was elected first Vice-President and M. M. SONNTAG, former Minister of Agriculture and a large landowner, is the second Vice-President, while Dr. REICH has been appointed General Secretary. The Academy, is well supplied with funds and will thus be able at once to enter upon its programme of scientific work.

Agricultural and Scientific Institutions and Associations.

440. **Netherlands: International Comittee of Phytopathology and Economic Entomology.** — The Report of the Secretary, Herr T. A. C. SCHROEVRS, on the work of the Committee for the period 30 June 1923 to 1 January 1925 has now been issued. The Committee was formed on the occasion of the First International Conference on Phytopathology and Economic Entomology, held in Holland in 1923 (see *International Review of the Science and Practice of Agriculture*, Vol. II, 1924, No. 1, 288), with headquarters at Wageningen (Holland), Nassauweg 28.

After printing the report of the Conference the question of the practical application of the resolutions adopted arose. After arranging the necessary preliminaries two meetings of the international Committee were held under the presidency of Prof. H. M. QUANJER At the first, which took place in Brussels on 27 May 1924, a preliminary discussion as to the date and place of the next conference, took place, and also on the relations to be established between the International Committee and the International Institute of Agriculture. The following subjects were also discussed: the enlargement of the Committee by the inclusion of representatives of Russia, South America and China; plans for the collection of the funds required by the Committee in view of the preparation and organization of Congresses; the addition to be made to the funds for the Eriksson prize, intended for the assistance of deserving students, in carrying on experimental work in plant diseases and insect pests; the collection of information and publication of documents referring to phytopathology and economic entomology, etc.

M. LOUIS-DOP, Vice-President of the International Institute of Agriculture and Delegate of France and the French Colonies, was present in an unofficial capacity at the second meeting of the Committee, held in Paris on 9 October 1924. Both M. DOP and Dr. J. H. van RIJN, Delegate of Holland at the International Institute of Agriculture took an active part in the work of that Committee, and the Paris meeting was concluded by a resolution to the effect data in respect of agricultural instruction during the scholastic year 1921-22: there were three higher schools of Agriculture with 1242 students, two schools of forestry with 481 students, 206 agricultural intermediate schools with 9184 that arrangements were to be made with the International Institute of Agriculture, in accordance with the terms of Resolution 15 of the Seventh General Assembly of the Institute, for the organization of the Second International Conference on Phytopathology and Economic Entomology at Rome in 1925.

In view of new proposals made shortly after the meeting, the President and the Secretary of the Wageningen Committee, in considering the position in January 1925, decided to approach the Government of Czechoslovakia with the request that it would undertake in 1927 the work of organizing the Congress which the Czechoslovakian Republic had originally offered to welcome in 1926. This Congress is to be held in co-operation with the International Institute of Agriculture and with the International Association of Institutions for Plant Protection, provided that the proposals of the President and the Secretary of the Wageningen Committee, regarding the constitution of the Association are accepted. Draft rules for this Association form a part of the report to which reference is here made.

If this Association is formed and officially recognised by the International Institute of Agriculture, the President and Secretary of the International Committee propose that the first general assembly of the Association shall be held in 1927, at the same time as the Second International Conference of Phytopathology and Economic Entomology and that up to the time of the inauguration of this assembly the Council of the Association shall consist of the Wageningen Committee.

441. **United States: International Institute of Cooperation.** — A meeting of farmers organizations and co-operative undertakings was recently held at the Department of Agriculture, Washington, and a resolution was unanimously passed, urging the calling of a conference during the current year for the foundation of an *International Institute of Co-operation* in the United States. The immediate questions to be decided at the conference appeared to be: (1) collection and utilization of the facts relating to the co-operative movement in the United States and other countries; (2) the present position of the co-operative movement; (3) the preparation and professional training of managers and employees in the theory and practice of co-operation; (4) assistance to educational institutions, with a view to the improvement of the instruction relating to co-operation; (5) the utilization of the co-operative movement as a means of collective and national progress. (*The Agricultural Gazette of New South Wales.* Vol. XXXVI. Part 1. January, 1925)

442. **Germany: Bavarian Bureau for the Sale of Materials for Increasing Crop Yields and for the Protection of Crops.** — An agreement, to come into force on 1 January 1925, has been reached between the Bavarian Government, represented by the Director of the Government Institute for the Cultivation and Protection of Plants (*Landesanstalt für Pflanzenbau und Pflanzenschutz*), and Herr LAUERER in Munich, in virtue of which LAUERER has undertaken the exclusive sale in all the agricultural districts, on account of the Institute and in accordance with the instructions and prices as fixed by it, of bacteriological cultures, remedies for plant diseases and generally

for controlling all crop parts and also all apparatus required for the purpose. It is understood that sale will be confined to the cultures, remedies and apparatus prepared by the Institute or by other persons on its behalf, and the Office may sell substances and apparatus of foreign manufacture only when it has in each case the express permission of the Institute (*Praktische Blätter für Pflanzenbau und Pflanzenschutz*, Year 11, Part 2, 1925).

443. **Austria : State Activity in Lower Austria in regard to Land Improvements.** — In a report published by Herr STUTZ director of the Technical Agricultural Section of the Government Hydraulic Office of Lower Austria (*Tätigkeitsbericht des Vorreferates für Kulturtechnische Angelegenheiten der n. 8 Landesregierung für das Jahr 1924*, Vienna, 1925) an account is given of the work accomplished in the different communes of the region by the Office which in 1923 had 134 improvement works under its charge. In 35 communes 1 473.73 hectares had been drained and 10.089 square metres of open ditches had been dug for drainage purposes. The total cost amounted to 9664 million crowns. In order to facilitate the completion of these works, the Lower Austrian and the Federal Governments granted loans without interest to Consortia for Improvements in the proportion of 60 to 90 % of the total cost. Repayment of these loans is to be made within 3 to 7 years after the completion of the work. The amount of the loan and the date of repayment are fixed with reference to the financial and economic circumstances of the Commune in which the improvement works are being carried out An irrigation plant has been installed in one of the Communes and in others, 73 in all, a water supply has been installed, and in addition there have been 40 schemes of other types. The Technical Section already mentioned drafts such schemes free of charge, supervises the work in Progress and approves it when completed. Certain works have had to be deferred temporarily on account of lack of funds.

444. **Brazil : Yield of the Seed Farm in São Simão (Brazil) from 1920 to 1922.** — " O Serviço de Inspecção e Fomento Agricola " of the Ministry of Agriculture, Industry and Commerce of the State of San Paolo has published a collection of statistics showing the quantities of seeds, cereals, forage plants, etc., produced in the period stated and amounting in all to 7335.74 quintals. This report gives a general idea of the financial aspect of the production. (*Serviço de Inspecção e Fomento Agricola, Ministerio da Agricultura, Industria e Commercio. Producção do Campo de Sementez de São Simão*, 1925).

445. **Brazil : New Agricultural and Zootechnical Services.** — By a recent decision the Government of Santa Catherina has established a remount station at Joinville, where a considerable dairy industry is developing.

The Government of Parahuja do Horte, with the object of making provision for the cattle-pasturing industry, has published a degree by which a *Serviço de Defensa Pastoril* (Service for the Protection of pasture lands) is constituted. (*Brazil-Ferro-Carril*, Year XV, Vol. XXVII, No. 376, 1924 and Year XVI, Vol. XXVIII, No. 379, 1924).

446. **American Parasitological Society.** — At a meeting of students and others interested in parasitological studies, held at Washington, on 30 December 1924, the American Society of Parasitologists was formed for the presentation and discussion of new and important facts and problems in this branch of study and for the adoption of measures and proposals to encourage

in the United States the development of instruction and experimental work in parasitology. The members of the Society may be either, members with full voting and other powers or honorary members. Every person interested in parasitology is eligible for full membership.

447. **International Society for the History of Science.** — This Society has been founded in the United States with the object of ensuring the continuance of " Isis ", an international review dealing with the history of science. The review, which is edited by G. SARTCH (Cambridge, Mass.) has become the official organ of the Society of which L. G. HENDERSON (Cambridge, Mass.) is the chairman, and D. E SMITH (Columbia Univ. New York), the Secretary.

448. **British Committee of Agricultural Meteorology.** — The British Ministry of Agriculture and Fisheries has appointed a permanent advisory Committee for all questions relating to agricultural meteorology.

449. **West Indies : Report of the Agricultural Department of St. Vincent for 1923.** — The Report deserves careful study; the account of experiments with varieties of sugar-cane is of special interest at the present time. In regard to crop pests, it is shown that success may be obtained by community action. The description of researches on cotton should be studied by growers of West Indian cotton ; during the last two years there has been great improvement in the yield per acre. Reference is made to Land Settlement and Credit Societies. (*Report by the Imperial Commissioner of Agriculture for the West Indies*, 1924).

450. **The National Research Council in Italy.** — This Council was established as a corporate body by a Royal Decree of 16 November 1923, and is affiliated to the International Research Council the head quarters of which is at Brussels. Its objects are : (*a*) to co-ordinate and encourage national activity in the different branches of science and applied science ; (*b*) to keep in touch with the different Governments in regard to all questions relating to the sciences and their practical applications, the solution of which is of interest and value to the country ; (*c*) to establish and direct, where required, scientific laboratories of a general and special character. The annual receipts of the Council are made up as follows : (1) the annual contribution allotted from the Education budget ; (2) contributions by public or private bodies either as donations or subscriptions ; (3) possible working profits Its capital is built up (*a*) from donations made for the purposes , (*b*) from funds assigned with this object by the Council, out of any surplus on the yearly budget. (*Bollettino Scientifico Tecnico*, Year VI, No 6, 1924).

451. **National Association of the Agricultural Press in Italy.** — Founded on 1 January 1925. Its objects are as follows. (*a* to protect the moral and professional interests of members ; (*b*) to establish joint services of information and enquiry : (*c*) to organize by common agreement the consideration and advocacy of questions of interest to national agriculture and suitable propaganda, and to develop Italian Agriculture ; (*d*) to make effective provision for the proper insurance of members.

452. **Russia : The Technical Chemical Bureau of the Russian Sugar-Refining Union at Kiev.** — The work of this Bureau is to train chemical experts for the refineries belonging to the Union and to carry out scientific research in the chemistry of the refining process. Consideration is being given

to the drafting of a model form for the reports on the regular work of the various manufactories belonging to the Russian Sugar Refiners Trusts. In 1923 the Office had already organized a central inspection of the chemical technique of the sugar-refineries under its control, and thus became fully acquainted with their requirements and deficiencies. Previous to this inspection, there had been shortages of output from the factories in proportion to the quantity of raw materials and to the entries in the laboratory note-books and the accounting registers, but now strict enquiry has been instituted into the causes of shortage resulting in more careful management both on the administrative and the technical side. The statistics collected for the compilation of the report on the first year's working of the central inspection are in themselves proof of improvement The general results will be discussed at a meeting of the chemical experts, and will serve as a basis for further improvements as regards the output of the refineries.

The Bureau is managed by a Committee of three members and the staff consists of a chemical engineer, five travelling experts, and a correspondence clerk. (*Zeitschrift f die Zuckerindustrie der Cecoslovakischen Republik*, Year XLIX (VI) No. 5, 1924).

453. **Russia: The Ukraine Committee for Scientific Agriculture.** — This Committee was formed to continue the work of the former Scientific Committee of the Imperial Ministry of Agriculture, and up to 1923 its headquarters were at Kiev. It was later transferred to Kharkof, the capital of the Soviet Republic of the Ukraine. In addition to the President's Office and the Secretariat, which among other duties maintain relations with the International Institute of Agriculture at Rome, the Committee is composed of the following sections.

1 A technical Secretariat, with a sub-section engaged in establishing scientific agricultural terminology in the Ukraine language and in publishing a dictionary of these terms, and other subsections in charge of bibliography, the library, the Review issued by the Committee, the museum and the correspondence;

2 The following sections: rural economy, meteorology, chemistry, soil science; botany, including systematic botany, plant physiology, seed selection the botany of cereals, marsh, industrial and medicinal plants, phytopathology and experiment stations; zoology, including entomology, bee-keeping and fish breeding, rural demography, stock-breeding, veterinary science, cultivation of pastures, methods of cultivation, horticulture, sylviculture, land improvements and agricultural instruction. In addition to these services there are nine Commissioners with special responsibilities for the protection of natural wealth, the general direction of the work of the district organizations as well as that of the Experiment Station, control measures against agricultural pests and drought, questions of irrigation and water supply, and of roads and communications, the utilization of the subsoil, more especially of the phosphate layers.

Conferences and Congresses.

454. **Spain: Proceedings of the Seventh International Congress on Olive Cultivation. Seville, 5-19 December 1924.** — The Organising

Committee of this International Congress has accepted the tender of the publishing firm' " Sucesores de Rivadeneyra ". The Proceedings will be distributed gratuitously to members of the Congress, and will also be for sale at 40 and 50 pesetas in paper cover or bound cloth respectively.

The Firm Rivadeneyra accepts advertisements relating to olive oil production for insertion in this important publication which will be published in Spanish and French.

455. **United States: Report on the International Dairy Congress, October 1923** (*received* 1925). — This report has been published by the United States Department of Agriculture, Washington. For 20 years past successive International Dairy Congresses have been held in different European countries The first was the Brussels Congress in October 1923, at which the International Dairy Federation was founded. There followed in order, the Paris Congress in 1905, a Congress at the Hague in 1907, at Budapest in 1909, at Stockholm in 1911, and at Berne in 1919. During the period of the War the Congresses were suspended, and it was not till 1923 that a series again took place namely at Washington, 2-12 October, at Philadelphia, 4 October and at Syracuse, N. Y., 5-10 October. The last Congress was organised by the " World Dairy Congress " in pursuance of the authority given by a Law of the United States Parliament, dated 3 March 1921. The co-operation of the American Government was secured through the Department of Agriculture as well as through the other Ministries, and the Congress was organised by agreement with the *Federation Internationale de Laiterie* and with the co-operation of the national and local organisations of the United States.

As already stated, conferences took place in succession at Washington, Philadelphia and Syracuse, where an International Dairy Exhibition was also held, including select breeds of dairy cattle acclimatized in the United States, dairy industry products, butter, cheese, condensed milk, etc , and all the equipment used in the industry itself. The programme of the Congress was comprehensive and discussions took place on all the questions relating to the object of the Congress, which was defined in the official programme as the establishment of an International exchange of recently acquired knowledge, both scientific and practical, relating to the dairy industry, and also the issue of a statement on the methods and results of the various ways of using milk and its derivatives for human food The report contains *in extenso* the communications made by a number of scientific experts in each of the 27 sections into which the Congress was divided. The international trade in milk, the increase of the milk yield in the United States, the working of the Regional Milk Council System in the United States, the employment of condensed milk and milk powder in human food, the milk supply of towns, questions relating to cheese-making, methods of technical instruction for the staff of dairies, the food value of milk, ice creams, methods of improving the food uses of milk, dairy instruction in various countries, the education of the consumer and co-operation methods, milk tests, milk transport, inspection of dairy products, feeding of dairy cows, the chemistry and bacteriology of milk, dairy equipment, scientific study of milk and milk powder, breeding of dairy cattle and their diseases ;— the above is a list of the subjects treated in the different sections of the Congress.

The Congress did not pass any resolution on the subject of international relations which are not as yet completely established. Besides the meetings a number of excursions were organized, enabling the members of the Congress to visit dairies, pasturage centres, laboratories, model farms, experimental institutes, etc.

In conclusion while the report may be said to form a complete encyclopedia on the subject of milk, the object which has been specially kept in view is to emphasize the influence of economic problems of international trade and consumption of dairy products; prophylactic methods of dealing with live stock diseases and supervision of the sanitary conditions under which stock is kept; the standardization of products, the effect of the consumption of milk and milk products on the general health and the importance of such consumption on the physical and intellectual development of the people. (*Proceedings of the World's Dairy Congress*, Washington, D. C., October, 2, 3; Philadelphia, Pa., October, 4; Syracuse, N. Y., October 5, 6, 8, 9, 10; 2 vol. in 8°, p. XVI + 1599. Washington, D. C., 1924).

456. **Great Britain: Sixth Congress of the International Federation of Professional Horticulturists, London, 28-30 May 1924.** — The publication of the Report of this Congress supplies an account from various sources of the situation of world horticulture, as well as an official statement of the activities of the Federation. The reports relate to the following countries: France: R. BARBIER, General Secretary of the Federation; Holland: H. C VALETON, General Secretary of the Netherlands Horticultural Federation; Belgium: C. PYNAERT, President of the Chamber of Belgian Horticulturists; Great Britain . S W. HALE, secretary of the Chamber of Horticulture; Switzerland: A STAHEL, Secretary of the Federation of Swiss Horticulturists.

A report of the working of the B I.E.N.H. (*Bureau International d'Enregistrement des Nouveautés Horticoles*), which is beginning to be freely used by horticulturists, explains the advantages offered by the Bureau to the discoverers of new species. As regards arbitrations and disputes as to international horticultural transactions, the Congress resolved that every Horticultural Association should, when necessary, place itself in direct communication with the Chamber of International Commerce and make use of its services Questions of phytopathology and the prohibition of importation were the subject of a detailed report by M. G PYNAERT and also of a report by Mr A. GIBBON on the Canadian Legislation for plant-diseases. In regard to quarantine measures, questions relating to bulbs, rose bushes grafted by the Manetti methods, orchids, fruit, etc., came up for consideration and in the discussion that followed a resolution was passed in favour of the meeting of an International Conference at Washington to examine afresh, and in all its bearings, the problem of the transport of living plants from the international point of view, and to secure that the methods of inspection and testing should be practical.

The next conference of the Federation will be held in Holland in 1925. (The International Federation of Professional Horticulturists, Report of the Congress held in London, Connaught Rooms, Kingsway, W. C. on the 23 and 30 May, 1924; 63 pp. in small 8vo. Orleans,).

457. **Denmark: Fifth International Chemical Conference at Copenhagen, 26 June to 1 July 1924.** — The Council of the Union of Pure and

Applied Chemistry unanimously adopted the proposals of the Committees, relating to the reform of nomenclature, bibliographical documentation and also on raw materials and industrial products, physico-chemical standards, pure chemicals for experiments, tables of constants, solid and liquid combustibles, ceramics, the preservation of foodstuffs, industrial hygiene, and scientific and industrial plant.

The reports of the Committees were supplemented by four lectures given by the following: E BILLMANN, on the quinhydrone electrode and its applications; — H BOEHR, on the problems of the atomic theory, — J N. BROENSTED, on some views as to the definition of acids and bases; — S P L SOERENSEN, on the solubility of Proteins

458. **Reports of the First International Seed Trade Congress.** — This Congress was held in London from 7 to 10 July 1924, simultaneously with the International Seed Testing Conference, and was attended by representatives of Canada, Czechoslovakia, Denmark, Danzig, France, Germany, Great Britain, Italy and the United States of America At its final sitting the Congress adopted an international model form of contract for the purchase and sale of seed for agricultural purposes Copies of this form are appended to the published report of the Congress (The Agricultural Seed Trade Association of the United Kingdom Report of the Proceedings of the First International Seed Trade Congress held in London, July 7 to 10, 1924, 74 pp in small 8vo)

459. **First World Energy Conference in London, 30 June to 14 July 1924.** — The object of this Conference was to lay the foundations for international co-operation in the utilization of energy in its various forms, including the ascertainment of all natural sources of energy, the economic use of combustibles, the industrial applications of energy, the standardization of industrial materials, international agreements for the employment of electric energy and for financing industry, for transport, scientific experiments, industrial schools, etc. Important economic problems were considered from the international standpoint and it was decided that the Second Conference should be held in Rome in 1927 A permanent international organization was formed with headquarters in London

The Conference was followed by the first reunion of the International Commission on Electricity which is endeavouring to standardize the regulations respecting electric machines and installations

460. **International Congress for the Scientific Organization of Labour.** — Prague, 20 July 1924.

461. **Report of the First Pan-Pacific Food Conservation Conference.** — The General Proceedings of this important gathering, which was held at Honolulu from 31 July to 14 August 1924, have been published in the *Mid Pacific Magazine* (Vol XXIX, No 1: January 1925), with very striking illustrations The resolutions passed at the Conference had been already reported in the *Bulletin of the Pan-Pacific Union* (New Series, No 60, 1924)

462 **International Congress of Agriculture, Warsaw, 21-24 June 1925.** — This Congress, proposed by the International Commission on Agriculture, as announced in the *Int. Rev. of Sc. and Pract. of Agric.*, Jan.-March, 1925, No. 200, will include five Sections, whose programme is as follows.—

Rural Economy: 1. Influence of the agricultural organizations on the agricultural policy of the State; 2. Effect of capital and labour as factors tending to intensification of agriculture; 3. Large and small agricultural undertakings as influencing commercial relations between nations; 4. Present organization of the national rural credit institutions: organization of international rural credit; 5. Post-war agricultural crises; fluctuations in production and consumption in the different countries and disproportionate rises in prices; 6. Immigration and emigration of rural labour; 7. Improvement in the methods of rural labour.

Plant Production: 1 Use of gas and electric motors for agriculture; 2. International organization of the control of plant diseases and its practical realization; 3. Value and importance of lupins according to the latest experiments; 4. Application of the principle of standardization in agricultural production; 5. Economic use of phosphatic fertilizers according to the latest experiments; 6. New problems and new methods of control of drought.

Animal Production: 1. Importance of local breeds; 2 New opinions as to the nutritive value of forage crops, the importance of vitamines, character of the proteins, function of the mineral salts, etc.; 3 Feeding of dairy cattle in relation to:— (*a*) the classification of forage, (*b*) the keeping of milk records; 4. The relative value of the different breeds of horses according to the experience gained in the war; 5 Simplification of the methods of selection of domestic animals; 6. Modern pisciculture in stew ponds; 7. International agreements for the control of the diseases of domestic animals and their practical application in the case of the following diseases:— epizootic foot-and-mouth disease, contagious cattle pleuro-pneumonia, cattle plague, tuberculosis

Agricultural Industries 1. Development of the agricultural industry towards the form of the large industry and the interests of agriculture; 2 Organization of agriculture on industrial lines on the small rural holdings; 3 Beet-root sugar and cane sugar

Agricultural Experiment and Instruction — (*a*) 1 Organization of collective experiments over long periods and their importance for agriculture; 2. Co-ordination of agricultural experiment by means of an international agreement as to the best use of scientific work and the best means of advancing the solution of the various problems, 3 Organization and scope of the scientific institutions for agricultural investigations; 4. Organization of experiments in stock-breeding; 5 Unification of the methods for analysing fertilisers and seeds. (*b*) 1. Methods for diffusing vocational instruction among the rank and file of agricultural producers: adaptation of primary instruction and of the curriculum of the training colleges to the requirements of the rural population: after school instruction in agriculture: instruction in agriculture for ex-soldiers; how to utilize the experiment stations for agricultural instruction, 2. How to adapt the higher schools of agriculture to the changes which are coming about in the structure of rural life; 3. Organization of apprenticeship in agriculture

Papers relating to the subjects of the Congress must be sent to the Organizing Committee (30, Rue Kopernik, Warsaw) not later than 15 April and 15 May, the former date for the summaries of the papers and the latter for the completed texts.

463. **World's Forestry Congress. Rome, May 1926.** — The Organizing Committee intend that this Congress shall be conducted on thoroughly practical lines and that such problems only as are of real international importance shall be discussed. In particular the object of the Congress is to consider :—

(*a*) the possibility of unifying the present methods of compiling forestry statistics, of fixing the periods when the census should be made in the different countries and of establishing a regular international service of forestry statistics and information ;

(*b*) the best means of improving international trade in timber and other forest products ;

(*c*) technical, economic, legal and administrative questions relating to the proper preservation and improvement of existing forests, the regeneration of denuded mountain slopes and the utilization of waste land ;

(*d*) the best means of obtaining a better utilization of the world's forest reserves ;

(*e*) any other question of international importance relating to forestry.

The Congress will have 4 Sections, corresponding to the divisions of the Programme

I. FORESTRY IN ITS STATISTICAL, POLITICAL, ECONOMIC AND LEGAL ASPECTS. INSTRUCTION IN FORESTRY.

1. Statistics of area, production, consumption and trade.
2. Census taking, including uniformity in method and frequency.
3. Forests in relation to the general interests of a country.
4. State intervention in the afforestation of bare lands belonging to private persons, Communes, Associations, etc , and in the improvement of existing forests.
5. State intervention in the administration of forests owned by private persons, Communes, etc.
6. The organisation of the State Forestry Services in various countries.
7. Legislation relating to forests.
8. Revenue from forests. Taxation.
9. Credits for forests
10. Forestry instruction in different countries.
11. Research, experiment and information stations.

II. TRADE AND INDUSTRY IN TIMBER AND OTHER FOREST PRODUCTS.

1. Action to be taken for the improvement of the international trade in timber and forest products, including the unification of commercial methods and practice, model contracts, unification of commercial timber measurements, etc.
2. Tariffs for timber transport.
3. Customs duties.
4. Unification of the customs classification of forests products.
5. Saw-milling industry
6. Manufacture of wood pulp for paper-making and of cellulose, and kindred industries.
7. Various industries engaged in the use and conversion of wood.

8. Resin industry.
9. Other industries that make use of forest products other than wood.
10. Wood distillation industry.
11. Minor industries connected with forestry.

III. TECHNICAL PROBLEMS RELATING TO FORESTRY AND FORESTRY OPERATIONS.

1. The natural factors in production. Ecology applied to forestry.
2. Geographical distribution of forest trees.
3. Forest trees. The best timber trees for introduction and cultivation in the different climatic zones for the purpose of improving timber yields.
4. Forestry operations, including felling, transport, etc.
5. Collection of forest products other than wood, *e. g.*, barks, resin, saps, leaves, etc.
6. production of vegetable fuel (charcoal) and the usual methods of carbonization.
7. Collection and preservation of the seeds of forest trees.
8. Nurseries.
9. The offorestation of bare lands.
10. Chemical fertilizers in forestry.
11. Improvement of existing forests with special reference to production
12. Cultural practice and treatment of forests.
13. Working plans or schemes and their value.
14 Methods of seasoning and preserving timber.
15 Control of forest fires.

IV. REAFFORESTATION OF MOUNTAIN AREAS. CONTROL OF TORRENT WATERS. PLANT DISEASES MISCELLANEOUS

1. Preservation of mountain lands, pasture lands, lands fit for cultivation
2. Regulation of mountain water systems.
3. Artificial lakes in reference to the afforestation of bare lands, and the control of mountain water-systems
4. Improvement of pasture and agricultural land.
5. Planting and regulation of pasture lands belonging to Communes or Associations.
6. Control of torrent waters; major and minor works connected therewith.
7. Legislation on the correction of torrents, the control of mountain watersystems and mountain lands
8. Plant diseases, insect pests, damage caused by wind, fire, snow, etc., and methods of protection.
9. Tropical forestry resources and the possibility of their utilization for the benefit of countries with inadequate timber yields.
10. Forests in connection with the development of tourist activity and aesthetic education.
11. Propaganda work for forest and stream. Arbour day celebrations.
12. Game and fishing. Miscellaneous.

Reports must reach the Bureau of the International Forestry Congress at the International Institute of Agriculture, Villa Umberto I, Rome, before 15 February 1926.

The subscription is fixed at 50 French francs.

464. **International Congress for the Study and Protection of Birds, Luxemburg, 13 April 1925.** — This International Congress was held under the auspices of the Luxemburg Government and the League of Belgium, France and Luxemburg for the Protection of Birds. Apply: M. J. MORBACH, *Esch sur Alzette, Luxemburg.*

465. **International Goat Keeping Congress, Friburg, September 1925.** — This Congress will be held on the occasion of the Swiss Agricultural Exhibition and the discussions will deal with the three following subjects: 1. goats' milk, its composition and properties, 2. the diseases of goats, and particularly anemia and tuberculosis, as also prophylaxis and remedial measures; 3 feeding of goats with particular preference to the proper exchange of mineral substances.

466. **Winter Session in the " Agricultural Week " in Berlin of the Deutsche Landwirtschafts-Gesellschaft Berlin, 21 February 1925.** — Special sections and meetings took place for discussion of the methods respectively of cultivation, manuring, sowing, pomology and oenology, agricultural machinery, zootechnics, farmhouse management and colonial subjects Among the principal papers on agricultural scientific subjects placed on the agenda may be mentioned: Dr SCHWARTZ (Berlin-Steglitz) on the appearance of *Doryphora* in potatoes and control measures; Dr BAUR (St. Blasien) on meteorological forecasting at the different seasons of the year; Dr RAUM (Weihenstephan) on weed control in meadowland, Drs BIERREI (Gross-Dobritsch), GERLACH (Berlin) and Prof NEUBAUER (Dresden) on chemical fertilising substances Agricultural Councillor BUSZ (Rastatt) and Prof ZADE (Leipzig) contributed papers to the Seeds Section, Prof KROEMER (Geisenheim on Rhine) and the expert horticulturist A. J. WERTH (Bonneckenstein in the Harz) to the viticultural and pomological sections Other reports dealt with home gardening (Dr. EBERT, Berlin) and general household management (Frau BÖHM, Königsberg), farm machinery (Prof. E MEYER, Hohenheim; COLSMAN, Linderberg; OBENDORFER, Limbach, and DEKRER, Düsseldorf); lupin growing (Dr STORMER, Stettin-Neutorney, and BREDE, Klockow of Karstädt), and in the colonial Section, the conditions of agriculture in Turkey (Prof. BREDEMANN, Landsberg) and in Egypt (Dr SCHNELL, Berlin- Dahlem). Zootechnical reports were presented by RAU (Berlin) on horse-breeding; on cattle-breeding by Dr RATGEN (Wormeln) and by MUSSENMEIER (Berlin); Dr FRÖHLICH (Halle on Saale), Prof GOLF (Leipzig) and Dr von FALCK (Berlin) on sheep-breeding, BRUNING (Haus Südhoff) and TICK (Othel) on pigbreeding, von WANGENHEIM (Wusterhausen) on poultry-breeding, and in addition Prof HONCAMP (Rostock in Mecklenburg) gave a report on stock feeding as based on the results of the most recent experiments while Prof WIEGNER (Zurich) described experiments in forage preservation in Switzerland.

Reports were also presented of the many various branches of the activity of the *Deutsche Landwirtschafts-Gesellschaft.*

467. **Brazil: National Congress on Products yielding Oil, Fats and Resin.** — As a result of the proceedings of this Congress the general recog-

nition of many Brazilian raw materials was established, these being excellent substitutes for foreign products imported into Brazil on a large scale. Among these is "bataua", the seed of an oil-yielding plant native to the north of Brazil and possessing the same digestive properties as olive oil, and the "batiputa" another seed produced in the States of Parahyba, Pernambuco and Rio Grande do Norte, the oil of which is said to have valuable culinary and medicinal qualities. Seeds were also shown of a Rosacea which grows freely in the Amazon district and produces a drying oil which is a useful substitute for linseed oil.

Reports were presented on almond oil and on analyses of foreign imported oils These analyses show that the greater part of the olive oil imported contains up to 90 % of cottonseed oil, while most of the imported linseed oil contains up to 20 % of resins and various mineral oils, which could be obtained more cheaply in Brazil Communications were also read on the subject of coco-butter, the sale of which is prohibited by the Health authorities of Rio Janeiro, while the Congress passed a resolution declaring that there was no justification for this prohibition which did much to prejudice the trade in the product

Dr E LINDERBERG explained in some detail a theory on the fixation of types of linseed oil Dr L TRINDADO, delegate of the *Associação Commercial de São Paulo*, obtained acceptance of a resolution for the establishment of a Commercial and Technical Information Service on Brazilian raw materials, to be supported by the trade associations, the engineering and industrial societies, the Chemical Society and kindred associations of the Federal District and of the States of the Union (*Brazil-Ferro-Carril*, Year XV, Vol XXVII, No 378, 1924)

468 **Report of the Congress of the Municipalities of the State of Minas Geraes (Brazil).** — The reports of this Congress which was held from 3 to 10 June 1923 at Bello Horizonte are published in a volume of considerable size As regards agricultural questions in the Section on Labour and Stock-Breeding the following subjects may be mentioned . the preservation of forests and re-afforestation , artificial meadows, hay-making and ensilage , animals useful and harmful to agriculture, contagious diseases of stock, mounting stations and rural credit (*Annaes do Congresso das Municipalidades Mineiras*, reunido em Bello Horizonte de 3 a 10 junho de 1923 , large 16mo , pp. 659, with illustrations Bello Horizonte, 1924

469 **Spain : IV National Irrigation Congress, Barcelona, May 1925.** — The three previous Congresses were held respectively at Saragossa in 1913 and Seville in 1918, and Valentia in 1921 The following subjects will be discussed on the present occasion :—

Regulations for the utilization of public water supplies , report on the relation between the industrial utilization of water and the irrigation of agricultural land ; regulations for the use of the water from the Aragon and Catalonia canal ; the development of cultivation in relation to irrigation and home colonization ; irrigation consortia, facilities for their establishment and working ; relations between landowners and the surface irrigated ; promotion of small irrigation consortia

470. **Spain : Congress of Vine-Growers at Valentia.** – This meeting took place in November 1924 under the presidency of the chairman of the *Fe-*

deración de Viticultores de Levante, and there were present representatives of the Vine Growing Unions of *Rioja, la Mancha, Cataluña, Murcia* and *Alicante.* The following proposals were approved: (1) The introduction of declarations of crops and of the transport of wine as a practical precaution against fraud; (2) The complete application of the law of 1895 which regards as adulteration of wine the addition of any substance whatever which is not derived from the fermentation of the grape; (3) special tariffs for the transport of grapes or wine, intended to increase the consumption of these two products; (4) conclusion of commercial agreements with Belgium, Germany, Czecho-Slovakia, Poland and the South American Republics. Several recommendations were made relating to fiscal charges, vine-growing and statistics (*La Revista vinicola y de Agricultura,* Year XLIII, No. 24, 1924).

471. **Spain: Oil Conference, Madrid, November 1924.** — Representatives were sent by the Chamber of Agriculture, oil manufacturers, olive-growers, exporters, the Spanish Agricultural Associations and other bodies. Resolutions were passed with regard to: (1) the supply and distribution of olive oil in the national territory; (2) regulation of exportation A full report of the resolutions appeared in the periodical *El Progreso Agricola y Pecuario,* Year XXX, No 1367, pp 689-693, 1924

472. **France: 60th Pomological Congress, Angers, 18-19 September 1924.** — Promoted by the *Société Pomologique de France* The subjects of the agenda were as follows (1) mechanical cultivation in orchards, (2) catch crops, in connection with intensive fruit growing, (3) fruit culture as a catch crop in the vineyard, (4) systematic manuring of fruit trees, (5) improvements in fruit growing as the result of horticultural and pomological competitions, (6) insects and cryptogamic diseases of the strawberry, (7) fruit preserving. The next pomological conference will be held at Toulouse within the current year

473. **France. Franco-Belgian Conference of Small Holders.** Lille, 25-27, September, 1924.

474 **Italy: 14th Annual Reunion of the Italian Society for the Advancement of Science, Pavia, last week in May 1925.** — This meeting will follow immediately on the celebration of the 1100th Anniversary of the University of Pavia.

475. **Italy: The Fifth Italian Forestry Conference, Campobasso, 1925.** — Organised under the auspices of the *Federazione Pro Montibus* The subjects to be discussed are. (1) the new forestry legislation and its application; (2) scheme for a more extensive and more effective forestry policy in Italy; (3) the technique of re-afforestation according to the most recent views and experiments; (4) the improvement of mountain pastures in Italy; the work done and to be done; (5) woods, and common rights in regard to the application of the Royal-Decree-Law of 22 May, 1924 No 751; (6) improvement of mountain land and the regulation of torrent waters; (7) the National Parks of Italy

A large Forestry Exhibition will be held simultaneously with the Congress.

Exhibitions, Fairs and Competitions.

476. **Germany: Publicity Fair, Leipzig, 1-17 March 1925.** — Held in connection with the annual spring fair

477. **Belgium: International Exhibition of Modern Improvements in Town and Country Domestic Work. Laeken.** — Will be opened on 15 July under the presidency of the Minister of Agriculture, Baron RUZETTE, at the Institute of Farm Household Management (*Institut ménager agricole*) of Laeken. Some international meetings of great importance will be also held on this occasion: (*a*) representatives of Household management instruction; (*b*) representatives of Farmwomen's Circles in different countries; (*c*) representatives of Rural Betterment Committees: (*c*) representatives of Family Education. On the agenda of this last meeting is placed the important question of the use of electricity in the country districts.

Commissioner for the Exhibition · M DELACROIX, *Chaussée Romaine, Laeken* For information, apply to M CIELE, 40, Rue des Joyeuses Entrées, Louvain Belgium

478. **Brazil: Regional Seed Competitions in Brazil, 1925.** — The Minister of Agriculture of Brazil has approved the measures suggested by the "Serviço de Fomento" for holding seed competitions in 1925 in the following States: Amazon, Parà, Maranhâo, Cearà, Parahyba, Pernambuco, Alagoas, Bahia. (*Brazil-Ferro-Carril*, Year XVI, XXVIII, No 383 . 1924)

479. **Cuba: International Horticultural Exhibition. Havannah, 26 February-8 March 1925.** — For information apply to M P D de POOL Apartado 997, Havannah

480. **Spain: Fifth National Zootechnical Competition. Madrid, May 1926** organized by the *Asociación General de Ganaderos*, Huertas 30 Madrid.

481. **Spain. Zootechnical Competition, Xeres de la Frontera, 24-26 April, 1925.** — Organizing association the *Asociación General de Ganaderos* Programme *Horses;* saddle horses, pure bred Arabs, carriage horses, — *Asses;* Andalusian and similar breeds, Majorca, Catalan and Leon breeds, — *Cattle:* Andalusian breeds of Estremadura, foreign beef cattle, — *Sheep;* fine wool, semi-fine and ordinary, cross-bred improved for meat, foreign breeds, — *Pigs:* coloured Andalusian and Portuguese, Estremadura spotted breed, unspecified breeds, pigs for fattening, foreign breeds . crossbred for improving, — *Goats;* local breeds, Spanish breeds, *Poultry;* fowls and other kinds of poultry, — *Watch-dogs;* mastiffs, sheep-dogs, etc.

482. **United States: Permanent Exhibition of International Trade at New Orleans, U. S. A.** — The American Government has granted the Trade Association of New Orleans the use of one of the Army stores which were erected in the town during the war This building can be adapted as a permanent exhibition of international trade Merchants of the leading nations will be invited to send samples of their products

483. **Scheme for a Colonial Exhibition at New York.** — A Committee for carrying out this scheme has been formed by M EMILIO UTARD, with the co-operation of M. GASTON LIEBERT, Minister Plenipotentiary, Director of the French Information Bureau at New York and of M DE LA ZARRIE, editor of the Review, *French Colonial Digest*, published at New York

484. **France : International Rose Show. Bagatelle (Bois de Boulogne), 1925-1926.** — Will be held in the rose-garden of Bagatelle and will have special reference to new varieties. The plants must be grown in pots, and at least five specimens of each exhibit sent, accompanied by particulars of their place of origin, and stock, and when necessary information as to the proper management of the plant Apply to: M. Forestier, *Conservateur des promenades de Paris*, 4. *Route du Champ d'Entraînement, par Neuilly* (*Seine*).

485. **International Exhibition of " White Coal " and of Tourist Facilities, Grenoble, France, May-October 1925.** — The main object of the exhibition which is organized by the General Council of the Isère, the city of Grenoble and the Grenoble Chamber of Commerce, is to illustrate the progress made in recent years, in France and in other countries, in electricity regarded not merely from the side of production and distribution of energy, but also from the point of view of the applications of white coal to numerous branches of human activity. For information apply to M. Pierre Chabert, *Commissaire général adjoint, chargé de sections étrangères*, 61. *Boulevard Haussmann, Paris.*

486. **National Seed Fair. Paris, 17-25 January 1925.** — Organized by the regional office of the Nord and the departmental officers of the Seine, the fair was divided into four sections :— I a fair properly so-called, reserved : (*a*) for the associations of seed producers and for the Agricultural Experiment Stations ; (*b*) for the agricultural unions for the sale of seeds , (*c*) for farmers who only sell their own crops ; II an exhibition open to dealers in grain, and seed, including tubers ; III a special section for sugar beet seed IV. a section for new species of seeds. Apply · M Eugène Rousset, *Directeur des Services agricoles de la Seine*

487. **General Agricultural Show, Paris 10-15 March 1925.** -- The following divisions were included . (*a*) a competition of breeding animals, cattle, sheep and pigs ; a butter and cheese competition , a sheep-dog trial and a show of dead poultry, all open only to breeders and farmers resident in France, Algeria and the Colonies and Protectorates, and to the breeding societies and unions , (*b*) a competition for dairy, agricultural and horticultural produce, wines ciders, jams, brandies, poultry and various products, of French or Algerian origin, or coming from the French Colonies or Protectorates.

488. **England : International Food Exhibition. London, 11 April to 2 May 1925.** — Covering all the food industries and including foodstuffs and prepared foods, machinery and apparatus for the preparation, serving and preservation of such foods, kitchen stoves and utensils, etc.

489. **Italy : Italian Competition for the Manufacture of Agricultural Refrigerators.** — In view of the development of the manufacture and trade in these machines, the Department of Agriculture in July 1924 instituted a competition for the construction of refrigerators specially designed for the preservation of eggs, butter, poultry, fresh fruit and vegetables. The competition closes on 31 December 1925 and a credit of 600 000 liras has been opened to meet the cost of awarding prizes.

490. **Italy: National Exhibition of Pure and Applied Chemistry. Turin, Spring 1925.** — Among the twenty classes of exhibits the following relating to the agricultural industries may be mentioned : the fermentation

and distilling industries; — machinery and apparatus for chemical and agricultural chemical industries, — refrigeration; — fats and soap manufacture; — breadmaking; — leather, hides and tanning materials

491. **Italy: First Italian Forestry Exhibition. Campobasso, 1925.** — This exhibition will be held on the occasion of the Fifth Italian Forestry Congress. There will be seven sections: I. Forestry and forestry instruction; II. Forestry industries; III. Special exhibits; IV. Mountain Pastures; V. Improvements of Mountain and Hydro-electric works; VI Exhibition of the Agriculture of Southern Italy; VII. Shooting and Fishing

492. **First Exhibition of Industry, Commerce and Agriculture, Fiume, Italy. August-September 1925.** — Under the auspices of the Union for the Extension of Trade and Industry, and under the patronage of the municipality of Fiume All kinds of industrial and agricultural products are accepted: they are classed in groups and special exhibits (Exhibit of wines, food exhibits, etc).

493. **Germany: Transport Exhibition. Munich, June-October 1925.** Divided into four sections. Land transport, including railways, tramways, street vehicles of all kinds; sea and river transport, aerial transport; posts, telegraph, telephone and radiotelegraph

494. **Poland. National Horticultural Exhibition Lvoff, 26 Sept. — 5 Oct., 1925.** To be held contemporarily with a Conference on Horticulture. Apply, Exhibition Committee, Kopernika 20, Poland.

495. **Switzerland: Ninth Swiss Exhibition of Agriculture. Berne, 12-27 September 1925.** - Agricultural exhibits from other countries will only be accepted so far as they possess interest for the agriculture of Switzerland The Exhibition will include agriculture, forestry and horticulture For information, apply to the General Commissioner for the Exhibition, 7 Laupenstrasse, Berne

Development of Agriculture in the Different Countries.

496. **Brazil: An Important Problem for Brazil.** — According to Dr. TEIXEIRA, in the present economic conditions, so full of uncertainty for very many countries, it is only from the land that Brazil can expect a prosperous development of the native wealth to the point of maintaining a sufficiently large export of foodstuffs, besides meeting the requirements of the home market. The Governments of the States, with the support of the Federal Government, must secure an understanding with the landowners for obtaining the expropriation of land required for land settlement, and must divide it into convenient lots, approached by carriage roads and must sell these lots to Brazilians and foreigners. At the same time it would be necessary to organize a body of experts for soil study and analysis, to advise as to the crops suitable for the different types of soil, the nature and quantity of fertiliser required and the breeds of stock suitable for the different localities In this way a large demonstration area would be formed, which would effect great changes in Brazilian agriculture, and make Brazil a country of abundant food production (*Brazil-Ferro-Carril*, Year XV, vol XXVII, No. 376, 1924).

497. **Brazil: Cotton Cultivation in the various States of Brazil.** — The Superintending Section of the Cotton Growing Service of Brazil (*Superin-*

tendencia do Serviço do algodão), taking into consideration the varieties of cotton and the plantation of cotton in the different States, has resolved on a special type for each separate zone adopting the following divisions.

Para, Maranhão and Piauhy; for the inland zones, "Moco" or "Serido"; for the littoral and wooded regions, the herbaceous kinds.

Ceara, Rio Grande de Norte and Parahyba. for the inland zones. "Moco" or "Serido"; on the lands subject to annual flooding, the herbaceous varieties.

Pernambuco, Alagoas, Sergipe and Norte da Bahia. for the inland districts "Moco" or "Serido" as well as "Verdão" or "Riqueza"; on the littoral or the wooded parts, herbaceous kinds.

Herbaceous varieties are also planted in Espirito Santo, Rio de Janeiro, S. Paulo, Minas (Sul and the Triangle districts), Goyaz, Matto Grosso, Parana, Santa Catherina and Rio Grande do Sul.

The variety "Rim de Boi" will be grown in the region of the Norte de Minas Geraes, including the bay of S Francisco and the Southern part of the State of Bahia

Applications for seed, forwarded to the *Superintendencia*, must state the quantity of seed required as well as the area which it is intended to plant Persons who receive seed are under an obligation to restore, at the time of picking, to the *Serviço do Algodão*, a double quantity of seed. (*Gazeta da Bolsa*, Year VIII, No. 5, Rio de Janeiro, 1925)

498. **Community Cotton Production.** — COOK O F. and MARTIN R. D *United States Department of Agriculture Bulletin No* 1384, pp. 20. Washington, D. C 1924. Community production of cotton is the growing of only one variety in each district. Under this system, the deterioration of varieties is avoided, due to the mixing of seed at the ginneries; production is based on pure seed, superior varieties are utilised, better cultural methods are employed, greater efficiency is secured, and commercial advantages are obtained from the marketing of a uniform product An adequate supply of pure seed of a standard variety is fundamental

The bulletin outlines the one-variety community method of cotton production, including the selection of a variety, the maintenance of seed stocks, and the organisation of centres for the supply of pure seed

499. **English Wheats.** — HUMPHRIES D A. E. *The London Corn Circular Supplement*, pp. 1-2, January 12, 1925. The following notes are from a lecture given at the City of London College by Dr HUMPHRIES, the well-known authority on wheat, who has studied the various aspects of wheat for over twenty years.

About the middle of the last century the area under wheat in the United Kingdom was 4,000,000 acres, whereas in 1914 it had been reduced to 1,375,000 acres, and in 1923 was only 1,800,000 acres. In 1863, 72 % of the total consumption was home-grown; at the present time little more than 13 % of requirements reaches the mills

The best wheat is grown in the Eastern Counties, where the rainfall is relatively low. It has been supposed that England has not the natural conditions for wheat production, but this is not the case. The average yield per acre is 32 bushels, whereas that of the United States and Canada is about 15, and in Australia a little lower. As regards quality, ordinary English wheat is soft, but "Yeoman" is hard, even with a high water content. Eighteen years ago the author grew some Duluth wheat and produced a hard grain, and subsequently, in collaboration with Sir Daniel HALL, showed that fertilisers could not improve the inherent quality of a wheat. Red Fife was grown successively for 25 years and gave good quality, but a low yield. Professor BIFFEN of Cambridge studied the question, with the result that "Yeoman" was produced, and recently "Yeoman II", and varieties are produced to suit conditions.

The present position is that English wheat will now yield flour in the highest degree suitable for bread-making, and in a few years the position of homegrown wheat in England should be very different from that which it has occupied in recent years

500. **Italy: Home Colonization.** — Senator EDOARDO PANTANO, former President of the International Institute of Agriculture, introduced in the Senate on 20 January 1925 a bill by which it is proposed to found a National Institute for Home Colonisation, as a body corporate and under the immediate control of the Minister of National Economy A statement of the objects of this Institute and the means for their furtherance is to be found in articles 2 and 3 of the scheme By home colonisation is meant the utilization of the whole of the national agricultural assets by means of the direct or indirect intervention of the State Villages are to be built in uncultivated or scarcely cultivated areas, lying remote from inhabited centres, whence farms of the small or average-sized type can be directly organized small country towns can be formed in the neighbourhood of the well populated rural areas, thus making possible the scientific improvement of the small cultivator's holding Agricultural co-operation and mutual insurance, the diffusion of small cultivating ownership or tenancy, or where possible the systematic cultivation of the latifundia are all to be encouraged · agricultural industries, stock-breeding, the building of farmworkers' houses are to be in every way promoted The land improvements proper of lands either waste or inadequately cultivated are to be accompanied by improvements in water-supply and sanitation, and encouragement is to be given to all institutions which tend to the raising of the moral, intellectual and economic standards of life among the workers on the land.

Some account should be added of the means by which this great work of rehabilitation of the primary national wealth is to be carried out Among the methods to be adopted are: the purchase of waste lands, or of lands unscientifically cultivated, or excessively broken up, with the object of reselling when improved, put into good order, and where necessary reclaimed, in lots which will form as many farm holdings of small or average size, cultivated directly by the owner or by his family; rural credit in all its forms, lightening of fiscal burdens and technical agricultural assistance both to the rural co-operative societies for purchase or renting of lands to be jointly leased or assigned among the members, and also to owners of large estates (latifundia) In the latter case, the result would be, according to local circumstances, to bring about either grants in emphyteusis of the estate, whether parcelled out or otherwise, or the cultivation or partial change in the system of cultivation of the land, the owner instituting such forms of associated labour as would allow for profit-sharing. Support will also be given to all the different institutions and schemes mentioned in the bill as suitable for the furtherance of the objects in view. The proposal deals, in separate chapters, with grants in emphyteusis, loans on favourable terms, and fiscal facilities; the National Endowment Fund for the Institute, amounting to a milliard liras; agricultural notes and rural credit: the internal regulation of the Institute; the foundation of new villages and country towns; land purchases and expropriations; emigration, rural property belonging to the State, the provinces, the communes and corporate bodies; workers' co-operative societies and co-operative land-holding societies, families of ex-service men who are to receive lots for settlement, penal farm and reclamation colonies; rural credit; chemical fertilisers and farm implements; land settlement in Sicily and Sardinia; orchard cultivation; Parliamentary supervision and regulation. (*Per la colonizzazione interna.* Bill proposed by Senator EDOARDO PANTANO Extract from the *Atti Parlamentari*, January 1925).

501. **Rumania: Agrarian Policy and Agricultural Production in Rumania.** — Under this title Prof G JONESCU-SISESTI, of the Higher School of Agriculture, Bucarest, and Director of the Rumanian Ministry of Agriculture, has brought together in a complete work five articles, which have already appeared in different reviews and deal respectively with. Rumanian agriculture in general, agrarian relations, the Rumanian agrarian reform and its consequences, co-operation in agriculture, and Rumanian agricultural production in comparison with that of the other Danubian countries. The chapter on agrarian relations gives a summary but precise historical account of the conditions of the rural population before and after the great reform of the abolition of serfdom, which was carried out in 1864, and was followed in 1866 by the "law for agricultural agreements", in virtue of which large landowners came to the assistance of peasants either by supplying them with land for farming, or providing cereals or money in exchange for services This law, which virtually though indirectly re-introduced serfdom by its extremely harsh provisions, was amended in 1862 and again in 1882, but was only finally repealed in 1906, when it was replaced by new provisions regulating hiring agreements, rent-paying and produce-sharing tenancies A new epoch is thus marked in Rumanian agrarian policy

A point of departure is thus formed for the advent of the important recent reform of 1919, which freed the peasants completely from any dependence on the holders of the latifundia and in accordance with which Rumania became a country in which the small holding is the prevailing form of land tenure

The author treats his subject exhaustively, explaining the full consequences of the agrarian revolution which took place and is still in progress in his country. He concludes by a comparative survey of the position of agriculture in Rumania, Jugoslavia, Bulgaria and Hungary. (G. JONESCU-SISESTI. *Structure agraire et production agricole de la Roumanie*, pp. 62, 8vo, Bucarest, 1924).

502 **Russian Requirements in Agricultural Machinery and Implements.** — According to figures of farm implements and machines supplied by the Soviet Government Stores the following percentages represent the number of applications for these requisites which it proved possible to meet in the first half of 1924, (that is to say the goods were supplied as against payment by in-

stalments): for ploughs 6.8 %, rapers 3.4 %, binders 0 7 %, reapers and binders 10.5 % mowers 9.5 %, threshing-machines 11.5 %, separators and churns for butter-making 5.3 %, sifters 3.8 %. Apart from the ploughs, the demand for agricultural machinery and particularly for harvesting machinery was much in excess of the supply On the other hand the monopoly of the foreign trade made it impossible to introduce agricultural machinery from other countries. (SCHERMANN Die russische Landwirtschaft. *Technik und Wirtschaft*, Year XVIII, Part I, 1924).

Miscellaneous Notices.

503. **Uniform International Analysis-Methods for Oils and Fats.** — Work in preparation for the international unification of the methods of analysis is proceeding in the special laboratories of a large number of States. An Italian Commission had already completed the work of collating the methods of analysing oils and fats and, on the occasion of the last Cogress of Chemistry at Milan had called a meeting of the principal representatives, both on the scientific and technical side, of the manufacture of oils, soaps and stearines, etc , with the object of laying the foundations of an international agreement as to the methods and principles by which the raw materials and the finished products of these industries should be judged At this meeting the collection thus made in Italy was recognised to be for the moment the most complete and the most recent in existence A similar Commission is now being organised in Germany, consisting of the representatives of the industry and of eminent scientists, with headquarters at the *Wissenschaftliche Zentrale für Oel und Fettforschung*. This Commission is making use of the Italian collection and also of special work accomplished in the different branches of industry and especially of the work of Dr GOLDSCHMIDT on the analysis of the raw materials of the finished products of stearine manufacture and the reports of Dr GREITEMANN on the manufacture of oils and edible fats. (*L'industria degli oli e dei grassi*, Year 1, Nos 11-13, 1924)

504. **Germany: Hydraulic Power in Bavaria.** — Among German States Bavaria is richest in water power According to the *Wirtschaftsdienst* of Hamburg-Kiel (21 November 1924), which contains the figures of an enquiry made in this connection by the Bavarian Ministry of the Interior, the State should possess a hydraulic power utilised and utilisable of 1 330,000 kilowatts, that is an average of 2,000,000 H P of which about 500,000 are used. It is reckoned that, by the construction of the Rhine canal to the Main and Danube it should be possible to obtain 3,000,000 H. P, resulting in an annual yield of 12 thousand million kilowatt-hours equivalent to 12 million tons of ordinary coal

505. **Austria: Water supply secured for a Mountain Pasture by Means of the Divining Rod.** — Prof. ALBRECHT, Director of the Agricultural School of Pyhra, describes the difficulty of watering the live stock in the Gahnweide pasture, which is entirely without springs though otherwise fertile and situated on a spur of the Schneeberg in Lower Austria Efforts were made, by bringing rain water to the larger cowhouses, etc , to provide enough drinking water, and in years of heavy rainfall this plan was successful In dry seasons, however, the stock suffered from thirst and had to be temporarily removed elsewhere. In the summer of 1924 an expert water-diviner went thoroughly

over the pastures and traced a vein of water at a depth of 7 metres. A well sunk on the spot proved sufficient; water was at once found at this depth, and the well was finally sunk to 10 metres, and even after four months of a dry season was full of water. A motor-pump was installed in the spring of 1925. (ALBRECHT. Die Wünschelrute im Dienste der Almwirtschaft. *Die Landwirtschaft*, Part 1, 15 Janury 1925, Vienna).

506. **Brazil: Cotton Standards.** — A special Committee, which met on 31 December 1924 at the headquarters of the *Associação Commercial* of Maceio (State of Alagoas, Brazil) has fixed three classes for the cotton of the North (do Norte): short, medium and long staple and each class in five types: 1. superior; 3. good: 5. moderately good; 7 fair; 9. inferior. The differential criteria among the three classes mentioned were established as follows: for the short staple (Mattas): 2 % between type 1 and type 3; 3 % between types 3 and 5; 3 % between types 5 and 7, 4 % between types 7 and 9. For the medium staple (Sertoes): 2 % between the types 1 and 3; 3 % between types 3 and 5; 4 % between types 5 and 7; 5 % between types 7 and 9. For the long staple (Seridó). 2 % between types 1 and 3; 3 % between types 3 and 5; 5 % between types 5 and 7; 7 % between types 7 and 9 The length of the staple is then determined in 22-28 mm. for the short staple, 28-34 mm for the medium staple; 34 mm and over for the long staple kinds. (*Boletim da Associação Commercial*, Year IV, No 123. Maceio, Estado de Alagoas, Brazil, 1923)

507. **Brazil: Rural Hygiene in the State of Rio de Janeiro.** - The *Serviço de Saneamento Rural* in Rio de Janeiro has published a report of Dr MARIO PINOTTI on the prophylactic measures taken against malaria in the North of the State during 1924 A sketch map is attached and the report is also illustrated by graphs showing respectively the preventive use of quinine, the complete figures for the measures adopted for counteracting the effect of marshlands at Itinerante, Campos, S João de Barra, Macahe and Itaparuna, the reduction in the malaria cases on two remedial sub-stations and the cost of the curative use of quinine (Serviço de Saneamento Rural no Estado do Rio de Janeiro. *A campanha antimalarica no Norte do Estado em* 1924 by Dr. MARIO PINOTTI, 1924).

508. **Belgian Congo: The Albert National Park.** — In accordance with a decision reached between the King of the Belgians and the Minister of the Colonies there will be established in the northeast portion of the Belgian Congo at an altitude of 300 to 400 metres between Lake Kuon and Uganda a park in which the flora and fauna will be officially protected, and a royal decree will be issued forbidding hunters to enter the zone selected (*Science*, Vol. LXI, No. 1574, 1925).

509. **Spain: Radiotelephony for the Diffusion of Information on the Breeding of Small Live Stock.** — A lecture given by Prof. GASPARE BALERIOLA on sericulture was broadcasted on 27 October 1924 from the *Radio-Ibérica* Hall in Madrid; on 29 October a lecture on poultry keeping by Dr RAMÓN J. CRESPO, technical director of the poultry farm belonging to His Highness the Prince of the Asturias, was transmitted, while on 3 November 1924 a third lectnre was broadcasted with the object of diffusing information on beekeeping by Dr TEODORO J. TRIGO. director of "*La Moderna Apicol-*

tura". These three lectures have been published *in extenso* in *La Industria Pecuaria*, Year XXV, No. 821, pp. 498-506, 1924, Madrid.

510. **France: The Cinematograph in Instruction on Poultry-Keeping.** — Professor VOITELLIER of the *Institut National Agronomique* has published a pamphlet on the principal breeds of poultry, the original feature being the 70 photographs accompanying the description taken from two films which VOITELLIER had prepared for purposes of giving instruction in poultry breeding. These two films are already in circulation and belong to the cinematograph service of the Ministry of Agriculture. There is also an official scheme for the preparation of a number of other films for educational purposes with a text in pamphlet form to correspond to each. The legends accompanying the screen pictures are on the one hand in some detail, so as to allow of their being used as a supplement to lectures or courses in poultry-keeping, while they are kept sufficiently short so as to avoid tedium. (*La Vie agricole et rurale*, Year 13, No. 40, 1924)

511. **Great Britain: Sugar Beet.** — The Government has decided to carry out the proposals respecting a subsidy, which will apply to sugar manufactured during the current season The subsidy will be at the rate of 19s. 6d. per cwt for the four years 1924-1928, at the rate of 13s per cwt. for the three following years; and at the rate of 6s 6d per cwt. for the three final years of the ten year period These rates will apply to sugar of a polarisation exceeding 98 degrees, for sugar of lower polarisations the rates will be reduced according to scale The sugar factories will pay excise duty at the preferential rate, at present 9s 8 $^2/_3$d per cwt

Among the seven factories which it is proposed to construct, five will be erected in the course of 1925

It will be a condition of payment of the subsidy that manufactures should pay during the first 4 years a minimum price of 44s per ton of beet of 15 ½ % sugar content, with an addition or deduction of 3d per ton in respect of each $^1/_{10}$ per cent of sugar content above or below 15 ½ % (*Journal of Surveyors' Institution*, Vol. IV, Part 7, London, 1925)

512. **The History of the Sugar-Cane.** — According to an article in the *South African Sugar Journal* of 1924, the sugarcane did not come originally from the Western Hemisphere, but was introduced from Madeira in 1420 and into both North and South America after the voyage of Columbus In North America it was cultivated for the first time about 1751 in the neighbourhood of the present New Orleans, by Jesuits coming from San Domingo. The first mention of sugar-refining in Louisiana dates back to 1758

513. **A Series of Volumes on the South Australian Flora and Fauna.** — A series of *Handbooks of the Flora and Fauna of South Australia* is in preparation under the auspices of the British Science Guild, Section of South Australia. The work on the Flora has been carried out by J M BLACK except for the Orchidaceae, for which Dr. R. S ROBERS is responsible Up to the present only two volumes have been published out of the three which should cover the subject of systematic botany. In the first there is a short chapter which summarizes the history of the botany of South Australia, followed by a useful glossary of scientific terms. Keys are provided for the identification of the fam-

ilies, genera and species, and the descriptive matter is accompanied by excel illustrations.

This publication forms a valuable addition to the aids to study, which of so much importance for students of botany and also of agriculture, and wh illustrate in detail the vegetation of large tracts of the British Empire . th include the *Flora Capensis* of HARVEY and SONDER continued by Sir W Th SELTON-DYER; the *Flora of Tropical Africa* of Prof D OLIVER, continued b Sir W. THISELTON-DYER; the *Flora of British India* of Sir Joseph HOOKER, the celebrated author of *Icones Plantarum*, *Genera Plantarum*, and joint author of the great *Index Kewensis* for the phanerogams.

514. **Ancient Anglo-Saxon Manuscripts on Botany.** – In the *Journal of the Royal Horticultural Society* 1923, E. S. ROHDE gives a brief description of four manuscripts now in the British Museum and at present constituting all that remains in literary form of the botanical knowledge of the early English. These manuscripts are: the *Leech Book of Bald*, the *Lachnunga*, the translations of the Herbarium of Apuleius and the so-called *Peri Didaxeon*. (Quoted from the *Botanical Abstract*, XIV, No. 1, 1925).

515. **A New System of Carbonication of Plants.** — Attention has recent years been called to the importance of carbon dioxide as a factor vegetable growth, and various methods have been proposed of facilitating its assimilation by the plant. (See *International Review of the Science and Practice of Agriculture*, 1920 passim). A new method is now being proposed which combines simplicity and economy. The principle of this method consists in the employment of substances with high powers of absorption for atmospheric gases. These are to be sprinkled on the green parts of plants, so as to induce a more complete and rapid exchange of gases between the assimilating organs and the atmosphere. The author also refers to the anti-parasitic action of the substance suggested by himself and entitled « Vegetina » The experimental treatment described shows that there is a stimulus to growth which may be inferred from the fuller development and better condition of the plant so treated. (E. GNECCO. Esposizione di un nuovo sistema per aumentare lo sviluppo delle piante mediante un trattamento aereo e per renderle immuni da certe malattie. Rome, 1925).

516. **Italy: Protection of Typical Italian Wines.** – AVV. PIERO PAGANI, Deputy Procurator General at the Court of Appeal of Florence has published a comprehensive and detailed commentary on the Royal Decre Law of 7 March 1924 for the protection of the " vino tipo " prefacing his marks with a historical account of the protectionist systems in Norwa Sweden, South Africa, England, and Belgium, of the French and Portugues systems, and of the effect of free trade on the Italian system. The autho then discusses the detailed working of consortia in general and of wine-ma ing consortia in particular, and after expressing a criticism of the syst adopted in Italy, he explains his own views as to the practical applicatic of the term "vino tipico". (AVV. PIERO PAGANI. Il regime di "vino tipo tutelato. Supplement to part 3 of the *Rivista di Diritto agrario*, pp. 479-51 Florence, 1924).

517. **Italy: State Quinine.** – The Ministry of Finance, Departmen of Patents, has published a special monograph on the progress made in the go

ernment production of quinine in Italy. The statement of results of this production, technical, economic, financial and industrial, are prefaced by a historical survey of the legislative and statistical aspects of the question. It is well known that the example set by Italy of the sale of quinine on the State account has been followed by other countries, including Greece, Bulgaria, Austria, Russia, Holland, and generally by all civilised peoples among whom malaria is prevalent. The problem of "paludism" has been since considered by the *League of Nations* to be a question of international hygiene, and a special Section for "Malaria" has been established at Geneva.

The Italian publication referred to may be said to be complete on the subject of government quinine. It contains an array of facts, supplemented by a number of plates which reproduce everything which may be regarded of importance connected with the industry, buildings, laboratories, etc. (Il Chinino dello Stato dalle sue origini ad oggi — *Ministero delle Finanze, Direzione Generale delle Privative*, 4to. pp. 61. 15 plates, Turin 1924).

318. **Vine Growing and the Cinematograph.** — Good service in connection with the problem of the restoration of vineyards destroyed by phylloxera at Monferrato (Italy) has been done by cinematograph films on modern methods of vine-growing and on the grafting of vines on to American stocks, a practice which is being adopted with great advantage in this district. (*Il coltivatore*, Year 71, No. 2, 1925).

Journals and Reviews.

519 The *Zeitschrift für technische Biologie* has inaugurated a new series under the title of *Chemie der Zelle und Gewebe* a periodical on problems of fermentation, respiration and vitamines, edited by HUGO HAEHN (Berlin) and published by the Bruder Borntrâger at Leipzig.

520. *The "Kartoffelnummer" of the "Deutsche Landwirtschaftliche Presse"* — A special number of this old-established German agricultural periodical is dedicated exclusively to potatoes It contains a number of illustrations and a chromolithographic illustration representing fifteen varieties of potato tubers, which are resistant to black scab. The potato plant is treated from every point of view by scientists and experts and the result is a valuable collection of information particularly important to agriculturists. (*Deutsche Landwirtschaftliche Presse*, 53, No. 7, 14 February 1925).

321. The Centenary of the *Allgemeine Forst- und Jagdzeitung.* — In the *Forstwiss. Centralblatt* (XLIV, No. 173, 1924) the history of this periodica from its foundation to the end of 1924 is described.

522. The review *Technik und Wirtschaft*, the monthly journal of the Association of German Engineers, devotes a special number, January 1925, to Russia, designed as far as possible to make known in Germany the economic conditions of Russia especially in view of the economic relations which may be formed between the two great countries. With this object the editors have invited persons, specially qualified as having for some years followed the Russian economic movement, to contribute special articles. An introductory article by Dr. SCHERMANN (Berlin) deals with ordinary living conditions in Russia, housing, food, clothing, etc. Dr. S. VON OLDENBURG (Berlin) discusses the political

constitution and the Soviet finances, and E. von **Falkowsky**, vicepresident of the Association of Russian Advocates in Germany, the Soviet legislation. **Schermann** also deals with labour questions and in a lengthy article on Russian economic conditions surveys first agriculture and then industry, while the subject of trade is discussed by an anonymous Serbian author. The whole forms a booklet of 48 pp. in large 8vo with statistical tables and diagrams.

523. "*Producción*", a review of agriculture, industry, stock-breeding and engineering, which is published in Madrid, has devoted one number (Year VI, No. 99, 1924), with copious illustrations, to the Seventh International Congress on Olive growing in Seville. It includes the report presented by M. D. **Francisco Bilbao y Sevilla**, Delegate of Spain to the Permanent Committee of the International Institute of Agriculture and by M. D. **José Maria** de **Soros**, attached to the *Consejo Agronómico de España*, on the statistics of production, consumption, import and export of olive oil in the different countries. The report is illustrated by explanatory diagrams and by numerous statistical tables.

The different pavilions of the Exhibition of Olive growing are also described, and special emphasis is laid on the modern improved oil manufacturing plants which go far to make Spain one of the richest countries in this particular industry.

524. *El Crédito Agricola* is the title of a new monthly agricultural review, which was inaugurated at Madrid in January last under the editorship of J. C. **Navarro**. One of its features will be the publication, in the form of a separate appendix to the periodical itself, of the official regulations which may be of interest to readers. In this way the Law on agricultural unions and the consequential regulations (*Ley de sindicatos agricolas, Reglamento de los mismos*) has already appeared. Editing and Managing Office: Madrid, *Pilar*, 18. The first number contains among other matter, the draft scheme for the *Instituto de Crédito Agricola*, the capital of which is to be 100 millions of pesetas 75 millions given by the State and repayable for instalments the remaining 25 supplied by the agricultural associations.

525. The *China Chemists' and Druggists' Review*. is a new Chinese periodical of Chemistry and Pharmacy 'which appears every month in Shanghai in two languages, English and Chinese.

526. The **Rockefeller** Foundation has assigned 350,000 dollars to the review "*International Biological Abstract*"

527. A new periodical for the oil and fat industry is announced under the title of the *Journal of Oil and Fat Industries*, under the auspices of the *American Oil Chemists' Society*. Editor: B. S. **Bailey**, Savannah, Georgia, U.S.A.

528. *The India Rubber Journal*, the oldest established periodical in connection with rubber cultivation and manufacture, celebrated its fortieth anniversary in 1924, and published a special double number on the occasion.

529 "*De Indische Culturen*". -- Under this new title is combined the 34th year of the old-established review *Teysmannia*, and the tenth year of the *Ned. Ind. Rubber-en-Thee Tidschrift*, which is published at Soekaboemi (Java). Although different agricultural topics, cultivation of tobacco, tea, sugar-cane, coffee, etc., are dealt with in special reports of the Experimental Station of the

Dutch Indies, *De Indische Culturen* will have a large range of its own to cover in all the other branches of tropical agriculture.

530. A *Bibliography of Polish Botany* has been published (*Polska bibliografia botaniczna*) in the Acta Soc. Bot. Poloniae of 1924.

Personal.

531. The library and the collection of plants belonging to Mr. J. P. ALDERSON of Juneau, Alaska, a well-known student of the Alaskan flora, who was preparing a work on the mildews which attack the vegetation of that region, was completely destroyed by fire on 12 November 1924.

532. In the *Journal of Botany* (LXIII, No. 745, 1925) there is an obituary notice of CHARLES BAYLEY, member of the Linnean Society and honorary Doctor of Science of the University of Manchester. BAYLEY bequeathed to the University his valuable herbarium, containing specimens collected by himself and catalogued also by himself in two manuscript volumes, compiled in a period of fifty years. He also left the University his library, containing not only botanical works but also works on other branches of science with special reference to Palestine, Egypt and Chaldea. He founded at Manchester a small association of enthusiasts for microscopic research work called the "Leeuwenhoek Club".

533. In the *Tharandter Forstliches Jahrbuch* (LXXV, Part VI, 1924) an account is given of the writings of RICHARD BECK, who died on 18 November 1923 and had been for nearly 30 year Professor of Forestry at Tharandt. Besides numerous original contributions to the literature of forestry, some of which gained prizes, together with his memoir on the re-afforestation of areas belonging to small agricultural holdings uneconomically cultivated from the point of view of agriculture and forestry, which took the Reuning Foundation Prize, he undertook the revision of several manuals. The part dealing with forestry in the third and fourth editions of the LOREY-WAGNER manual (*Handbuch der Forstwissenschaft*) is his work, and the revised edition of the well known treatise by HESS (*Lehrbuch über den Forstschutz*) appeared in the fourth edition under the name HESS-BECK.

534. Dr. HORACE TABBERER BROWN, well known for his important work on ferments died recently at the age of 70 years.

535. Dr. G. A. DEAN, Professor of Entomology at the *Kansas State Agricultural College*, was recently elected President of the *American Entomological Society*.

536. On 8 February of last year the death took place at Carlsruhe of the Privy Councillor Prof. CARL ENGLER, a chemist of world-wide celebrity, especially for his investigations into the chemistry of the petrols and the processes of auto-oxidation. A biography of ENGLER was published on the occasion of his eightieth birthday in 1922 by Dr. F. HABER in the *Chemiker Zeitung*.

537. Dr. FRANZ E. GELDENHUYS has been recently appointed by the Minister of Agriculture of South Africa chief of a new division of agricultural economics and markets in the Department of Agriculture.

538. The death of Baron MAURICE GERARD was announced in December 1921. He was a member of the *Académie d'Agriculture* and one of the founders

of the Norman Herd-book and his stock-breeding farm of Maisons near Bayeux (Calvados) was considered a model. Baron **GERARD** instituted at the *Académie d'Agriculture* a permanent foundation of 2000 francs yearly for the benefit of French stock-breeding. For more than 30 years he devoted himself to selective breeding of the Norman breed of cattle, and his herds constantly brought him credit in competitions.

539. In Miss **LILIAN SUSETTE GIBBS**, plant ecology has lost a keen investigator. Her work on the mountain flora of Australasia and on questions of the geographical distribution of plants was well known to the scientific world.

540. **GOTTLIEB HABERLANDT**, the eminent plant physiologist, who investigated the " sense organs " of plants and founded the theory of vegetable " hormones ", has celebrated his 79th year. In *Naturwissenschaften* **CORRENS** has published an excellent biographical memoir of **HABERLANDT**.

541. Dr. L. J. **HARRIS**, of the School of Biochemistry at Cambridge, has received the *Meldola Medal* from the Council of the Institute of Chemistry for his work on the chemistry of the proteins.

542 Prof. **ALEXANDER HERZFELD**, the Privy Councillor, who has from 1887 been at the head of the Berlin *Institut fur Zuckerindustrie*, has completed his 70th year. This Institute which has a world wide reputation was formed from the private laboratory of **SCHEIBLER**, and the credit for its organization belongs to **HERZFELD**. His work on the analyses, the separation, saturation and solubility of sugar and on sugar inverts takes a place among the most modern researches on the subject

543 **RICHARD IRWIN LYNCH**, for forty years curator of the University Botanical Garden at Cambridge, died on 7 December 1924 at the age of 74

544. Dr. E. E **KLEIN**, Fellow of the Royal Society, London, who died recently at the age of 80 was a pioneer in normal histology and one of the founders of modern bacteriology

545. Prof. **GIUSEPPE LO PRIORE** has been transferred to the Chair of Botany of the Portici Higher Institute of Agriculture (Naples).

546. The Canadian Society of Technical Agriculturists at its last annual meeting at Guelph Ontario, conferred honorary membership of the Society on Mr. W. T. **MACOUN**, a horticulturist in the Dominion since 1910, for professional merit.

547 The meeting of 19 January 1923 of the *Académie des Sciences* at Paris was suspended owing to the death of one of its members, Prof **LÉON MAQUENNE**, the former pupil of **DEHERAIN**, and successor of **VILLE** in the chair of Plant Physics, holding in addition later that of Plant Physiology and succeeding **DUCLAUX** in the *Académie des Sciences*. His work on sugar, the respiration of plants, and the part of certain minerals in vegetative life is well known. By preparing carbide of calcium and other carbides, he anticipated in some degree the discoveries of **MOISSAN**.

548 The death of Dr. **JAMES MILLS**, president for 25 years of the Ontario Agricultural College, is announced.

549 Dr. R. K. **NABOURS**, Chief of the Department of Zoology in the Kansas State Agricultural College, has been elected a member of the Advisory Committee of the Eugenics Commission of the United States.

550. By the death of KARL FREDERIC OTTO NORDSTEDT, the eminent algologist, Sweden has lost one of her most renowned botanists, A list of more than one hundred books and articles published by NORDSTEDT is given by Dr. GERTZ in the *Botaniska Notiser* and extends over a period of scientific activity of more than 60 years. The most important refer to the algae and the *Index Desmidiacearum nordstedtiano*, published in 1896, was for a long time the model of its kind. Apart from the great master of the subject, ALEXANDER BRAUN, no one had so great a range of knowledge of the *Charophytae* as the lamented Swedish botanist. He was for forty years attached to the Lund Botanic Institute.

551. Prof. J. K RAMSBOTTOM died at New York on 2 February 1925. He was well known in scientific circles for his work in mycology and in connection with bulbs. His research work on the " Eel-Worm Disease " of bulbs gained for him in 1912 the gold medal of the Royal Horticultural Society, and there is no doubt that as a result of his work very serious damage to the bulb industry was averted.

552. The Italian Association of Hygiene, on the occasion of its annual meeting, is proposing to present a gold medal to Dr. A. SCLAVO, Professor of Hygiene at Florence, in tribute of his services in the cause of hygiene in Italy.

553 By W. G. SMITH, in *Nature* (113, 683-684, 1924) there appears a monograph on Prof J. E. B WARMING, who died on 2 April 1924 and whose work has had an important influence on botanical writings in general He was especially known for his ecological publications and it is probable that more than half of the 3000 works referred to in the last edition of his manual on ecology were inspired and influenced by his own work. WARMING's contributions to botanical literature extended over more than 60 years He was born in 1841 in Jutland and was professor of Botany at the University of Copenhagen from 1885 to 1911.

554. The death on 30 January 1925 of WILLIAM WATSON has recently been announced. He was formerly curator of the Royal Botanic Gardens at Kew, and possessed an unrivalled knowledge of tropical and sub-tropical botany and was equally an expert in horticultural questions.

555 Another well known scientist, JAMES ALFRED WHELDON, who died on 28 November 1924 will be remembered for his valuable contributions to botanical studies and particularly for his work in biology His publications on this subject are very extensive and appeared in the *Naturalist*, the *Lancashire Naturalist*, the *Transactions of the Liverpool Botanical Society*, etc His *Synopsis of the European Sphagna* is well known, and also his very important work on the *Flora of West Lancashire*.

Dott. GUIDO BORGHESANI, *direttore responsabile.*

To be published shortly:

Proceedings of the Fourth International Soil Science Conference

In May 1924, under the auspices of the International Institute of Agriculture at Rome, the Fourth International Soil Science Conference was held, in which many leading scientists from all parts of the world took part. Among those present were Professors Ramann (Munich), Andersen (Stockholm), Glinka (Petrograd), Winogradsky (Paris), Von Sigmond (Budapest), Ganssen (Berlin), Keen (Rothamsted), Robinson (Bangor), Stoklasa (Prague), Murgoci (Bucharest), Lipman (New Jersey). The discussions of such a representative and truly international Conference cannot fail to interest all persons concerned, on the theoretical or practical side, with the different branches of agricultural science.

The proceedings of the Conference are about to be published by the International Institute of Agriculture. In addition to the more strictly official section, including *inter alia* the debate which led to the formation of the International Society of Soil Science, the " Proceedings " will contain the discussions of the six Commissions of the Conference. No less than 150 communications on the various aspects of Soil Science were made to the Conference, and some of the more important discussions are reported in full, including those on standardisation in the methods of research on soil acidity, organic matter in soil, etc.

The texts of the communications and contributions by Winogradsky, Lipman, André, Stoklasa, Keen and Menozzi will be published in the original language of the authors and will be accompanied by a résumé in French and English. The volume will also contain a number of illustrations, tables, graphs, etc.

This publication with its varied contents should prove an invaluable reference book for all scientific institutions, as also for those interested from the point of view of commerce or industry in the progress of agricultural technique. It provides for students of pure and applied science a wealth of statistics, and records of experiments of far reaching importance as regards the most advantageous utilization of agricultural land, and the descriptions of new and improved methods in Soil Science research will be of special value to laboratories for agricultural experiment and analysis.

The Proceedings will be sold to subscribers, who are not members of the Society, at the price of 100 francs, 6 dollars, or 30 shillings post free. After publication the trade price will be fixed at 150 francs, 9 dollars, or 40 shillings.

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